BULLETIN

OF

THE UNIVERSITY OF TEXAS

NO. 106

ISSUED SEMI-MONTHLY

OFFICIAL SERIES NO. 27 APRIL 1, 1908

High School Bulletin

PUBLISHED BY
THE UNIVERSITY OF TEXAS

Entered as second-class mail matter at the postoffice at Austin, Texas

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Cultivated mind is the guardian genius of democracy. . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

President Mirabeau B. Lamar.

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INTRODUCTION

The interests of the University of Texas are correlative and co-extensive with the interests of the high schools of the State. The growth of the University in number and quality of students must depend upon the increase in number and efficiency of high schools. The University strives to assist high schools in adjusting courses of study, in selecting suitable equipments, in providing adequate buildings and efficient teachers; the high schools, in turn, prepare more and better students for higher training.

When the University opened its doors to students, in 1883, no provisions were made for the affiliation of high schools. All students were admitted on examination or on individual approval. At that time there were few public high schools in the State. An examination of the catalogues of the schools now affiliated discloses the fact that nine-tenths of these schools have been organized since 1883. The Houston High School sent out its first graduate in 1879. The first graduating class of the Dallas High School consisted of eight young ladies, who completed the course in 1887.

When the University began work with a strong faculty, in 1883, it met with sore disappointment. The 221 students who applied for admission were not prepared for college work. The only preparatory schools in the State were private academies. The teachers of these academies had been trained in Eastern colleges and usually directed their graduates to the colleges which they had attended. For the two succeeding years, after the opening of the University, the number of students diminished.

Soon those in authority began to realize that they were attempting to build a University without providing a foundation. They began to realize that it would be impossible to have a great State university without an efficient system of elementary and high schools. So, within the scholastic year 1885-86, the first provisions were made for the visitation and affiliation of high schools. Only four schools were affiliated during the first year. Since that date, with the exception of the year 1890-91, the number of students enrolled in the University, each year, has exceeded the enrollment of the preceding year. However, it does not seem that the Uni-

versity improved its opportunities or discharged its full duty to the schools. For ten years the matter of affiliation received little attention. But during the year 1895-96 the University again turned its attention to the high schools. The subjects in which schools might be affiliated were named, schools were visited, and some attempt was made to give form to the work. From this time the proper relationship of the University and schools began to be appreciated. The results of this relationship began to manifest themselves in the development of high schools and in the enrollment and work of the University. A progressive committee on affiliated schools was provided in the Faculty. This committee gave much time to the applications and visitation of the schools.

Possibly nothing, however, has been of greater service to the schools than the publication of Bulletin No. 1, entitled "Suggestions Concerning Courses of Study and Methods of Teaching in High Schools." This bulletin was published February 1, 1901. It gave a conservative estimate of the high schools and contained suggestions for their betterment. This bulletin was made one of the chief topics for discussion at the State Teachers' Association the following year. The high school teachers were glad to acknowledge a debt of gratitude to the University for its publication. This bulletin was revised, enlarged, and republished as Bulletin No. 47, July 1, 1905.

While the bulletin has been a single factor in the development of the schools, it may be of interest to note a few changes in the schools and in the University since the date of its publication. In 1901 schools were affiliated in English, History, Mathematics, Latin and Greek; the University now offers affiliation in eighteen subjects. In 1901 ninety-three schools were affiliated with the University; there are now one hundred and thirty-seven schools on the affiliated list. The increase in numbers by no means compares with the internal growth of schools. In 1901 the Ball High School, for example, was affiliated in five subjects, whereas it is now affiliated in eleven subjects. The growth of the schools has demanded an increase in the number of subjects for affiliation, and the University has responded to the demand.

As previously stated, when the University was first opened, the students were not prepared for college work, and the University was forced to adopt low-standard entrance requirements. In truth,

it did much work which should have been done by high schools; but now, with one hundred and thirty-seven high schools affiliated, the University believes that it may leave preparatory work to these high schools, and, for the first time in its history, do real college and university work. In 1901 there were 1121 students enrolled in all departments of the University; this year the enrollment in all departments aggregates 2462 students.

The authorities of the University believe that the growth of the schools, the development of the University, and the changes in entrance requirements warrant the publication of this High School Bulletin.

THE AFFILIATION OF SCHOOLS

REGULATIONS GOVERNING THE AFFILIATION OF SCHOOLS

1. When the authorities of any school desire affiliation with the University, formal application may be made to the Visitor of Schools. Memoranda blanks will be furnished to the superintendent or principal of the school seeking affiliation. Upon these blanks may be indicated the courses of study in the different branches, the number of teachers and their qualifications, and such information in regard to the apparatus, libraries, laboratories, etc., as may serve to give a fair idea of the general efficiency of the school.

2. If the information indicated be satisfactory, the authorities of the school may be requested to submit specimen examination papers prepared by students pursuing the high-school subjects in which affiliation is desired.

3. No school will be affiliated before the Visitor of Schools, or some person designated by him, shall have visited it and shall have rendered a report concerning its equipment and work.

4. If the Faculty shall be satisfied that the school should be affiliated, the authorities will be duly notified, and the name of the school will be entered, under the proper group, on the list of affiliated schools. The list will be published in the catalogue of the University.

5. To be affiliated at all, any school must prepare its graduates for the Freshman Class in English, History, Algebra, and Plane Geometry. Complete affiliation includes enough other subjects to admit graduates to the Freshman Class without conditions. To be admitted without conditions, fourteen units will be required of all students.

6. Graduates of affiliated schools applying for admission to the University will be credited with the number of units completed, provided that eight units must be offered by students from schools of the third group, eleven units by students from schools of the second group, and fourteen units by students from schools of the first group. Students from schools of the second and third groups will be required to pass examinations on enough units of work to

bring their credits up to fourteen, the number required for entrance to the Freshman Class of the University. Students not presenting the minimum number of units for the respective groups of schools from which they come will lose the advantages of affiliation.

7. Affiliation may be secured in the following subjects with their respective credits:

Prescribed:

(1) English, 3 units.
(2) History, 2 units.
(3) Algebra, 1½ units.
(4) Geometry, 1½ units.
(5) A Foreign Language, 3 units, or two Modern Languages, 2 units each, beginning with September, 1910.

Elective:

English:

(1) English, 1 unit.

History and Civics:

(2) History, ½, 1, 1½, or 2 units.
(3) Civics, ½ unit.

Languages:

(4) Latin, 3 or 4 units.
(5) Greek, 2 or 3 units.
(6) German, 2 or 3 units.
(7) French, 2 or 3 units.
(8) Spanish, 2 or 3 units.

Sciences and Mathematics:

(9) Physics, 1 or 2 units.
(10) Chemistry, 1 or 2 units.
(11) Botany, 1 or 2 units.
(12) Physiography, ½ unit.
(13) Physiology, ½ unit.
(14) Solid Geometry, ½ unit.
(15) Trigonometry, ½ unit.
(16) Manual Training, 1 or 2 units.

8. One unit represents approximately the amount of work done in thirty-six weeks with the equivalent of five daily recitations per week, having a minimum period of forty minutes. Many high schools do not yet reach the required standard, and four years may be required to make three units of credit in one subject.

9. The University, in offering this list of electives, does not anticipate that many of the affiliated schools will desire or attempt to offer instruction in all the subjects enumerated. The list is made for the purpose of extending liberty to the school authorities in adjusting courses of study to local needs. Schools should limit their courses of study to such subjects as they may be able to teach efficiently.

10. All schools seeking complete affiliation, that is, desiring to be placed in Group I of the affiliated schools, should strive to meet the following requirements:

(1) The high-school course of study should cover a minimum period of four years.

(2) The work should be done according to the departmental plan of teaching.

(3) The minimum length of recitation periods must be forty minutes.

(4) At least three teachers should teach exclusively in the high school. One of these might be the superintendent or the principal.

(5) Schools desiring affiliation in the sciences must provide adequate laboratories, as all students will be required to do individual laboratory work and present note-books properly kept before affiliation will be granted in any science subject.

SUGGESTIONS FOR THE PREPARATION AND SUBMISSION OF EXAMINATION PAPERS.

1. Specimen examination papers should be submitted from the highest classes in the subjects in which affiliation is desired. Outline maps should accompany history papers, composition work should be included in all language papers, and students' note-books will furnish the foundation for judgments concerning all science work.

2. Students should be encouraged to use uniform sizes of paper and note-books. In the preparation of papers answers should be

written with ink on one side of each sheet. Note-books should be prepared in the laboratories and notes should *not* be transcribed. The name of the writer and the name of the school should be written plainly on each paper.

3. Teachers should grade all papers and note-books before sending them to the University. Mistakes in the answers should be indicated. Note-books should show by means of suitable marks that the teacher did not permit mistakes to pass unnoticed.

4. The questions should be attached to the papers. The papers should be carefully wrapped and shipped, prepaid, to the Visitor of Schools, University of Texas, Austin, Texas.

GROUPS OF SCHOOLS AND COURSES OF STUDY.

The University is trying to serve four distinct groups of schools. The first group comprises all high schools preparing students for entrance to the Freshman Class of the University without conditions and without examination. The second group includes all high schools preparing students in at least eleven units of work. Graduates of these schools are credited with the work completed, but must pass examinations on enough units of work to make fourteen. The third group embraces all high schools fitting students for entrance to the Freshman Class with a minimum of eight units, but not having as many as eleven units to their credit. The fourth group includes all schools aspiring to reach the standards required for the minimum affiliation.

Group I is composed of high schools preparing students in English, History, Algebra, Plane Geometry, a Foreign Language or two Foreign Languages, and enough electives to make fourteen units of work.

Group II includes high schools providing satisfactory instruction in English, History, Algebra, Plane Geometry, and enough electives to make eleven units of credit.

Group III comprises high schools properly instructing students in English, History, Plane Geometry, and Algebra, a minimum of eight units of work.

The fourth group of schools embraces all schools offering instruction of any kind in high-school studies, but not doing sufficient work to entitle them to affiliation.

This grouping rests, we believe, upon natural and fundamental conditions underlying the normal growth of public high schools. It does not reflect upon any school of any group if all schools are doing their entire duty. It is made upon the basis of the amount of work that schools may be able to do, and not upon the basis of efficiency of work. The Group III schools are affiliated upon the presumption that their English, History, and Mathematics are as well taught as these subjects are taught in Group I schools. The same minimum amount of ground must be covered in these subjects in all groups of affiliated schools.

Among the fundamental conditions determining the group to which any school will belong may be named the following: The number of pupils ready for high-school training, moral and financial support of the school, buildings and equipments, and the number and training of teachers.

The number of pupils seeking high-school training ordinarily bears a certain relation to the financial support of the school. The financial resources of the school will largely determine the nature of the buildings and equipments, and the number and grade of teachers that will be employed. In villages and towns not having private schools the number of high-school pupils should bear a fairly fixed relationship to the number of elementary-school pupils needing instruction. The number of pupils of scholastic age in a town is used with a considerable degree of accuracy in estimating the number of inhabitants. The number of inhabitants, except under abnormal conditions, will bear a certain relationship to the wealth of the town.

Towns depending upon agricultural conditions pass through certain natural stages of growth. The schools in these towns also pass through certain steps in the courses of their evolution.

Good high schools can not be maintained at the expense of elementary schools. A lasting structure can not be erected without a solid foundation. The number of teachers that may be employed, consistently, for the high school will bear a definite relation to the number of teachers employed in the elementary schools.

The belief is here expressed that villages and towns with small numbers of pupils prepared for high-school work should not attempt to cover too much ground with their high-school courses. Blind ambition leads to failure; in the organization of high schools,

it leads to superficiality and false standards. Pupils and patrons are misled and irreparable injury results. When small towns attempt to rival larger towns and cities they strain themselves and destroy natural growth. In passing from village schools to well-equipped city high schools, each step as shown in the classification given above will be made. In some towns the steps may be taken more rapidly than in others.

Data collected from the high schools now affiliated with the University show that the number of pupils per teacher in the richest and best high schools will average about thirty. A small number of schools have an average as low as twenty-five pupils for each teacher employed. One-half of the schools exceed an average of thirty pupils per teacher. If, in the largest and richest cities, where wealth is accumulated and where larger numbers of pupils will contribute to economy in handling them, per capita, the ratio of 30 to 1 is found, we may hold that in smaller and poorer towns this or a greater number of pupils, per teacher, will be required.

Since 25 to 30 pupils per teacher are found in efficient Texas high schools, we may safely take twenty-five pupils and one teacher as a minimum "school unit." In the first place, we may insist that it would be unwise in a public school to attempt to provide more than one teacher for this number of pupils. This one teacher would usually be the principal of the school and would have supervisory duties. Leading educators believe that no teacher in a high school should teach more than seven periods per day and nearly all concur in the opinion that six periods of teaching per day, or less, would be preferable. It is evident that a school of twenty-five pupils or less, having one teacher, with an average of six periods per day for teaching, should limit its course of study. This limitation should not only be in scope of subject-matter, but in years as well. Here, mistakes are too frequently made. One ambitious teacher, goaded, perhaps, by more ambitious patrons, will sometimes plan a course of study including English, History, Algebra, Geometry, Latin, and Physics, and possibly other subjects covering a period of three or four years, and attempt to do the work of a first-class high school. It would be far better to limit the course of study to English, History, and Mathematics and the length of the

course to two years until such time as the increase in the number of pupils will warrant the employment of additional teachers.

The first year of many so-called high schools is often used in doing work properly belonging to the elementary school. High-school courses should, we believe, presume that the pupils have studied English, including spelling, punctuation, the more general principles of concordance and structure of the sentence, and should have, at least, formed a budding taste for reading helpful books. Such a knowledge of United States History as may be found in the State adopted book on this subject should be required of a pupil on entering the high school. The study of the fundamental operations of arithmetic, including fractions, denominate numbers, and the principles of percentage and their application, properly belongs to the elementary school. These three subjects, English, History, and Arithmetic, comprising the work indicated, are frequently found in the first year of the high-school courses; that is, schools in order to have four years of work in their high-school courses, will sometimes include one year of elementary-school work.

If the work, indicated above, has been done, the first year's work in the one-teacher school may comprise English, including grammar, composition, and classics; Algebra; Ancient History, and possibly some science. In the second year, English should be continued, changing the grammar to rhetoric; Algebra should be completed, and possibly Geometry begun; Mediæval and Modern History would be substituted for Ancient History of the first year. some science or a foreign language might be added.

The question now arises as to what should be done with the pupils who finish this two-years' course. If the number of pupils ready for high-school instruction has not increased so that a second teacher may be employed, it would be better to cut off the work at the end of the second year. Pupils desiring further instruction will thus be forced to secure private instruction or attend other schools. If they have done two years of high-school work well, they may attend another high school without great loss of time. It is usually those pupils who have had poor courses or poor instruction who lose time in changing schools.

It is unfortunate that some pupils who would like to go on with their studies do not have the means to do so; it would be equally

unfortunate to imperil the efficiency of the work for all in an attempt to provide instruction for a few.

Twenty-five pupils and one teacher do not constitute a high school; they do, however, form one unit which is essential in the organization of all high schools.

A most difficult step in the development of a school is found in the change from a one-teacher school with twenty-five pupils to a good two-teacher school with fifty pupils. Forty high-school pupils are too many for one teacher and scarcely enough to justify the employment of two. With thirty-five to forty pupils the demand for more grades in the school grows stronger. The principal is apt to accede to the demand, enlarge and lengthen the course, increase his own work beyond his ability to perform, and, soon, begins to call upon the elementary teachers for assistance. The results are almost uniformly bad. The elementary teacher, in most instances, is not fitted for high-school work. If she is intellectually qualified, she is not physically able to teach a grade in the elementary school and also do efficient work in the high school. Another method is to cut down the length of the recitation periods, or, possibly, attempt to teach two classes at the same time. Either of these methods will bring poor results. With forty pupils it would be best to hold the course to two years of high-school work. When ten pupils are ready for the third year of high-school work, fifteen pupils will be ready for the second-year work, and twenty to twenty-five pupils will be ready for the first-year work. With forty-five to fifty pupils the course may be raised one year and an additional teacher may be added. The school is not yet a high school. It should, however, do three years of good high-school work.

With fifty pupils and two efficient teachers, a school may legitimately aspire to do a four-years' course of high-school work in English, History, and Mathematics. A four-years' course comprising English, History, Mathematics, and a language, requires sixteen periods of teaching per day. This would give to each teacher eight periods per day and deprive the principal of all time for supervision. The tendency is to attempt the four-subject course rather than the three-subject course, and usually results in more or less superficial work in one or more subjects.

Along with the three-subject course two elementary courses in

the sciences or three years in a foreign language may be taken, provided a three-years' history course is chosen. A school having two teachers and fifty pupils will have difficulty in providing and equipping laboratories for teaching the sciences. A school of this grade must usually teach the sciences theoretically. For this reason it might be better to give three years' work in a foreign language. The course consisting of English, History, Mathematics, and three years in a foreign language would require fourteen teaching periods per day. These could be equally divided between the two teachers, or six periods might be assigned to the principal and eight to the assistant. With two teachers the work should be organized on the departmental plan. When it becomes necessary for the principal to teach the advanced classes in all subjects, the assistant teacher is unable to do high-school work. The school should then lose its rank as a high school.

While a school having two "school units," or two teachers and fifty pupils, may prepare students in fourteen units of work, the requirement for admission to the University of Texas, we do not believe that this is the best type of high school. More work must be put upon the two teachers than they can properly perform. With the addition of another "school unit," or with three teachers and seventy-five pupils, still better work may be done; with four "school units," or with four teachers and one hundred pupils, first-class work may be accomplished.

While the University does not group schools according to the number of "school units" or the number of teachers and pupils they contain, it may be noted that schools with two teachers usually fall into Group III, those with two and one-half or three teachers usually fall into Group II, and schools with three or more teachers are found in Group I.

It may furthermore be noted that schools in Group III prepare students in English, History, Algebra, and Plane Geometry; schools in Group II usually teach, in addition to the subjects in Group III, a foreign language, while schools in Group I add the sciences and an additional language.

SUGGESTIVE COURSES OF STUDY FOR HIGH SCHOOLS

For One-teacher Schools.

FIRST YEAR.

1. English.
2. Algebra.
3. Ancient History.
4. Science.

SECOND YEAR.

1. English.
2. Algebra, Plane Geometry.
3. Mediaeval and Modern History.
4. Foreign Language.

For Two- and Three-teacher Schools.

FIRST YEAR.

1. English.
2. Algebra.
3. Ancient History.
4. Science.

SECOND YEAR.

1. English.
2. Algebra, Plane Geometry.
3. Mediaeval and Modern History.
4. Foreign Language.

THIRD YEAR.

1. English.
2. Plane Geometry.
3. Science.
4. Foreign Language.

FOURTH YEAR.

1. English.
2. Solid Geometry, Review Algebra and Arithmetic.
3. American History and Civics.
4. Foreign Language.

In a two-teacher school it will be best to omit a part or all of the science and foreign language work.

For Four- or Five-teacher Schools.

In a four- or five-teacher school an additional foreign language may be added. Two courses, a Latin course and a Modern Language course, may then be offered.

Latin Course.

FIRST YEAR.

1. English.
2. Algebra.
3. Ancient History.
4. Latin.

SECOND YEAR.

1. English.
2. Algebra.
3. Mediaeval and Modern History.
4. Latin.

THIRD YEAR.

1. English.
2. Plane Geometry.
3. Science.
4. Latin.

FOURTH YEAR.

1. English.
2. American History and Civics.
3. Science or Mathematics.
4. Latin.

Modern Language Course.

FIRST YEAR.

1. English.
2. Algebra.
3. Ancient History.
4. Science.

SECOND YEAR.

1. English.
2. Algebra.
3. Mediaeval and Modern History.
4. Modern Language.

THIRD YEAR.

1. English.
2. Plane Geometry.
3. Science.
4. Modern Language.

FOURTH YEAR.

1. English.
2. History *or* Science.
3. Mathematics.
4. Modern Language.

With well-equipped teachers for each of the subjects, English, History, Mathematics, Foreign Languages, Science and Manual Training, the following courses may be differentiated: an English course, a History course, a Mathematics course, Foreign Language courses, Double Language courses, a Science course, a Manual Training course. Each of these courses should stress the subject whose name it bears. Some of these courses would be much alike; yet, there would be some differences. The number of the courses offered in any school must properly consider the number of pupils to be taught.

English Course.

FIRST YEAR.

1. English.
2. Ancient History.
3. Algebra.
4. Science.

SECOND YEAR.

1. English.
2. Mediaeval and Modern History.
3. Algebra.
4. Modern Language.

THIRD YEAR.

1. English.
2. Science.
3. Plane Geometry.
4. Modern Language.

FOURTH YEAR.

1. English.
2. American History and Civics.
3. Science *or* Mathematics.
4. Modern Language.

History Course.

First Year.	Third Year.
1. English.	1. English.
2. Ancient History.	2. English History.
3. Algebra.	3. Plane Geometry.
4. Science.	4. Modern Language.
Second Year.	**Fourth Year.**
1. English.	1. English.
2. Mediaeval and Modern History.	2. American History and Civics.
3. Algebra.	3. Science.
4. Modern Language.	4. Modern Language.

Mathematics Course.

First Year.	Third Year.
1. English.	1. English.
2. Ancient History.	2. Plane Geometry.
3. Algebra.	3. Science.
4. Science.	4. Modern Language.
Second Year.	**Fourth Year.**
1. English.	1. English.
2. Mediaeval and Modern History.	2. Solid Geometry, Trigonometry.
3. Algebra.	3. American History and Civics *or* Science.
4. Modern Language.	4. Modern Language.

Latin and Modern Language Courses.

See courses for four- or five-teacher schools.

Double Language Course.

Insert modern language for history, second year, for science, third year and for science or mathematics, fourth year, in Latin course.

Science Course.

First Year.	Second Year.
1. English.	1. English.
2. Ancient History.	2. Algebra.
3. Algebra.	3. Modern Language.
4. Science.	4. Science.

Third Year.	Fourth Year.
1. English.	1. English.
2. Plane Geometry.	2. American History.
3. Modern Language.	3. Modern Language.
4. Science.	4. Science.

Manual Training Course.

The Manual Training may be substituted for the science work in the Science course.

REMARKS.

1. Each one of the suggested courses contains a minimum of four years' work in English, three years' work in Mathematics, two years' work in History, three years' work in a Foreign Language, and with the exception of the Manual Training course, two years' work in Science.

2. All of these courses are arranged on the four-subject basis, with five recitations, per week, in each subject. Should a five-subject basis be chosen the number of recitations per subject, each week, should be reduced to an average of four.

3. Various advantageous combinations may be made of these suggested courses. It is not at all contemplated that small high schools will offer many courses. These suggested courses are made with the hope that they may be helpful to Superintendents in adapting courses of study to local needs.

ENGLISH IN THE HIGH SCHOOL

(Four units may be offered.)

I. GENERAL PRINCIPLES.

The English studies of the high school are generally grouped under three heads, Grammar, Composition (and Rhetoric), and Literature. But, while for convenience these subjects are separately named, they are not in essence distinct and divisible; on the contrary, they are so closely interdependent that each is best studied and most effectively taught in the light of this correlation. And it is the failure to observe this correlation that has so often brought English teaching into disrepute.

Not only are these English subjects often divorced from one another; but what is worse, they are divorced from life. By this it is meant that the student, not only of the high school, but, alas, of the college also, at times fails to see that his study of grammar, of composition, and of literature is intimately bound up with every-day life; that whatever knowledge he has acquired of these subjects will be of incalculable advantage to him whenever and wherever he has occasion to think and to express thought, whether orally or in writing, in the study of science as well as of literature, on the play-ground as well as in the school-room, in the briefest exercise as well as in the most elaborate essay; in brief, every hour of his life, no matter what may be his occupation.

Having stated broadly these general principles, let us take up the three English subjects one by one and attempt very briefly to apply these principles to each. At the close of each section there is given a brief bibliography.

II. GRAMMAR.

In the teaching of grammar, what is to be guarded against is a systemless practicalism on the one hand and a too strict formalism on the other. That in one way or another grammar should be studied throughout the whole of the high-school course, the writer is thoroughly convinced. Indeed, he has at times to teach it himself in his University classes. It is earnestly recommended, therefore, that the high-school student be

required to master some standard high-school English Grammar, by the systematic study of the text-book in the first year of the high school and by constant reference thereto throughout the whole course.

As stated in Section I, grammar should be studied in intimate conjunction with composition and with literature. This does not look to the abandonment of a set text-book in grammar, but to the constant supplementing of the text-book by exercises in composition and by the analysis of literary masterpieces, at first preferably in prose.

Again, the bearing of grammar upon life should be shown by constantly taking account in a tactful and yet firm way of the pupil's conversation and of his papers in subjects other than English.

*Bibliography.**

1. Text-books† Suitable for High Schools: Allen's *A School Grammar of the English Language* (Heath); Carpenter's *English Grammar* (M.); Maxwell's *Advanced Lessons in English Grammar* (A. B. C.); West's *English Grammar* (P.); Whitney's *Essentials of English Grammar* (G.), or Whitney and Lockwood's *English Grammar* (G.).

2. Books for the Teacher and for Reference: Emerson's *History of the English Language* (M.), or Lounsbury's *History of the English Language* (H.); Morris and Kellner's *Historical Outlines of English Accidence* (M.); Kellner's *Historical Outlines of English Syntax* (M.); Onions's *An Advanced English Syntax* (Sonnenschein & Co., London); and the standard historical English grammar, that by Henry Sweet, of which there are three versions,

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* The abbreviations used in this and the following bibliographies are as follows: A. B. C.=American Book Co., New York; Al.=Allyn & Bacon, Boston; Ap.=D. Appleton & Co., New York; C.=T. Y. Crowell & Co., New York; F.=Henry Frowde, New York; G.=Ginn & Co., Boston; H.=Henry Holt & Co., New York; Heath=D. C. Heath & Co., Boston; Ho.=Houghton, Mifflin, & Co., Boston; Leach=Leach, Shewell, & Sanborn, Boston; Longmans=Longmans, Green, & Co., New York; M.=The MacMillan Co., New York; P.=G. P. Putnam's Sons, New York; Scott=Scott, Foresman, & Co., Chicago; Sibley=Sibley & Ducker, Boston; Silver=Silver, Burdett, & Co., New York.

†The text-books suitable for high schools, in this and the subsequent bibliographies, are arranged according to alphabetic sequence, not according to preference.

all published by Frowde: (1) *A New English Grammar,* 2 vols.; (2) *A Short Historical English Grammar;* and (3) *A Primer of Historical English Grammar.* For the teacher who desires to learn Old and Middle English at first hand, perhaps the best books are Smith's *Old English Grammar* (Al.) and Emerson's *A Middle English Reader* (M.).

3. Pedagogical Books: Carpenter, Baker, and Scott's *The Teaching of English in the Elementary and the Secondary School* (Longman's); Chubb's *The Teaching of English in the Elementary and the Secondary School* (M.).

III. COMPOSITION.

In most college catalogues the requirements for admission, so far as composition is concerned, are indicated by the following sentence: "No candidate will be accepted in English whose work is notably defective in point of spelling, punctuation, idiom, or division into paragraphs." But this statement represents the point of view not only of the colleges of the country, but also of the better secondary schools, for the statement was drawn up by the various joint associations of preparatory schools and colleges, including the Southern Association. In the judgment of the best secondary and collegiate teachers of English in the United States, therefore, the points to be emphasized in the teaching of composition are spelling, punctuation, diction, and the structure of the sentence and of the paragraph.

The few general principles that govern the management of these elements are set forth in every good high-school rhetoric, and with these principles every student of composition should be gradually familiarized both practically and theoretically.

The work in composition should be correlated with that in grammar by applying the principles of grammar to the correction of the pupil's own errors in inflection or in syntax. It should be correlated with that in literature by deducing the principles of composition from prose masterpieces, by applying these principles in turn to the other selections studied, and by frequently assigning themes from the literary masterpieces, both from those studied in the class and from those read at home. This is a point of vital importance, since most great writers have become such largely through the copious reading and careful study of good literature.

Moreover, the work in composition should be correlated with that in all the other subjects taught in the high school by occasionally selecting themes from those departments and by the departmental teacher's requiring good English in every exercise handed him. The teachers of history and foreign languages can greatly help the teacher of English and themselves by requiring frequent written exercises; and the English teacher should at times accept as exercises in composition the papers prepared for the teachers of history and foreign languages.

Above all, the composition work must not be divorced from the pupil's life. Hence most of the subjects should be such as naturally arise, in which he is already interested or can easily become interested. Even grown people write and speak ill when an opportunity is made instead of seized. In a word, the pupil must be made to see that he studies composition, not to be able to get up an essay for public reading on Friday afternoons, but to enable him to think, to write, and to speak the more clearly and effectively on whatever topic engages his attention at any time and in any place.

As already stated incidentally, the practice should be abundant; and, if the plan suggested is followed, the most effective sort of practice would be given every day, without the student's knowing it. Certainly no week should pass without some regular written exercise. These exercises should be corrected and, when necessary, rewritten in the light of the suggestions made by the teacher. It would be of immense advantage for the teacher to hold occasional personal conferences with each student concerning his compositions.

It is believed, too, that it is best to have the instruction in composition and rhetoric based on some good text-book. And it is expected that the graduate of the affiliated high school will have mastered theoretically and practically a book of the grade indicated in the bibliography.

To the work in composition, practical and theoretical, may profitably be devoted, as a rule, from two-fifths to one-half the total time allotted to English.

Bibliography.

1. Text-Books Suitable for High Schools: Carpenter's *Rhetoric and English Composition* (M.); Espenshade's *The Essentials of*

Composition and Rhetoric (Heath); Gardiner, Kittredge, and Arnold's *Manual of Composition and Rhetoric* (G.); Genung's *Outlines of Rhetoric* (G.); Herrick and Damon's *Composition and Rhetoric for Schools* (Scott); Scott and Denny's *Elementary English Composition* and *Composition-Rhetoric* or *Composition-Literature* (Al.).

2. Books for the Teacher and for Reference: Wendell's *English Composition* (Scribners, New York); Genung's *The Working Principles of Rhetoric* (G.); Genung's *Rhetorical Analysis* (G.); Hill's *The Principles of Rhetoric* (Harpers, New York); Baldwin's *A College Manual of Rhetoric* (Longmans); Lamont's *English Composition* (Scribners); Gardiner's *The Forms of Prose Literature* (Scribners); Newcomer's *Elements of Rhetoric* (H.); Brewster's *Studies in Structure and Style* (M.); Hart's *Handbook of Composition* (Eldredge & Bro., Philadelphia); Scott and Denny's *Paragraph-writing* (Al.); Webster's *English Composition and Literature* (Ho.); Woolley's *Handbook of Composition* (Heath); DeQuincey's *Essays on Style, Rhetoric, and Language,* edited by Scott (Al.); Brewster's *Representative Essays on the Theory of Style* (M.); *Baker's Principles of Argumentation* (G.); Brewster's *Specimens of Narration* (H.); Baldwin's *Specimens of Description* (H.); Lamont's *Specimens of Exposition* (H.).

3. Pedagogical Books: See 3 under Bibliography to Grammar.

IV. LITERATURE.

It is now a commonplace, yet one that can not be too often repeated, that the study of literature consists in the first-hand, intelligent, and sympathetic study of masterpieces, not in the learning of what some one else has said about these masterpieces. How, then, shall they be studied? It has already been suggested that from these literary monuments may be deduced the principles of grammar and of composition; and that these principles in turn will help to elucidate the meaning of the masterpieces. Of course, grammatical and rhetorical analysis may be carried so far as to take the life out of the best piece of literature in the world; but this would be impossible with a judicious teacher. And a modicum of such analysis is not only a test of the student's comprehension, but is perhaps indispensable to the full understanding of most literature.

Again, a piece should be studied in its historical setting: its relation to its author, the country in which he lived, the tendencies of the times, etc. Thus the work in literature supplements that in history and *vice versa*. By the judicious assignment of biographical and historical topics to the pupil he is not only interested from the outset, but he has prepared for himself the best possible background for the more strictly literary study that is to follow.

These preliminary issues settled, one may take up the selection itself. When possible, it should be read in its entirety in one or two sittings at home in order that everyone may acquire a working knowledge of the piece as a whole. A good help to the acquisition of such knowledge and, also, a test is to require a brief, coherent summary of the whole in the best possible English or occasionally in skeleton outline only. Then comes the time for a minute study: for the solving of specially difficult passages; for the dwelling on others noteworthy for nobility of thought and for beauty of expression; for the occasional memorizing of such passages; finally, for the consideration of the artistic worth of the whole and an adequate appreciation of what the masterpiece stands for in the world of thought and in the life of man.

All that has been said above applies equally to every type of literature. But the artistic element of the masterpiece varies with the type; we look, for instance, for different qualities in the lyric from what we do in the drama, and in the essay from what we do in the novel. Accordingly, every piece of literature should be studied in the light of the principles of the type to which it belongs. The pupil should be led to discover what are the essential characteristics of the type studied. Books especially helpful to the teacher in this regard are named below under the head of literary criticism.

If thus far much has been said of summarizing, of types, and the like, and little of the spirit, it is because to the writer there is no known way of getting to the immaterial and spiritual except through the material (words, paragraphs, verses, plot, characterization, etc.); and because he does not believe it possible intelligently to enjoy the spirit of literature without first being able fairly to understand its elements. Even the Divine Being was not genuinely apprehensible to mortals until He took upon himself the form of man. But the writer believes that it is the spirit that giveth life in literature as well as in religion; and that the appreciation of

the spirit of literature should be the goal of all English teaching. He is convinced, moreover, that a faithful trial of the above plan, which is substantially that of all the more successful teachers of literature, will not only rescue the teaching of English literature from much of its vagueness, but will also give it body and soul.

In literature, as in grammar and composition, it is best, it is believed, to base the instruction on a good text-book, but, as already indicated, not to limit it thereto. The systematic history of English and American literature should not be attempted until the later years of the high-school course; but by the end of that period the student should have mastered the broader outlines of the history of English and American literature as given in text-books of the grade indicated in the bibliography. It is suggested, therefore, that in the earlier years the histories be used merely as reference books, and that the consecutive and detailed study thereof be deferred until the final year of the high school.

Of course, a real mastery of these text-books carries with it the intelligent and sympathetic study at first-hand of a large number of literary masterpieces, both in prose and verse. And this sympathetic study of the masterpieces, as I said at the outset, is worth infinitely more than merely to know the history of English literature. Which masterpieces should be read or studied in a given year, will vary somewhat with the previous training, and the attainments of the particular class, and, sometimes, especially in the supplementary reading, with the individuals of a class. The final arbiter of which masterpieces a class should read or study and in which year, therefore, must be the individual teacher. It is hoped, however, that the "Graded List of Classics" suggested below, made by request and after consultation with some of the best English teachers of our State, may be of service to teachers as well as to students. The list includes only the works adopted, for the entrance requirements for the years 1909-1911, by the various associations of preparatory schools and colleges throughout the United States, including the Southern Association. The grading, however, has been done by the writer after consultation with the teachers referred to above. The chief criterion in the grading has been the relative difficulty of the classics as viewed by the writer; for this reason, the first year is devoted chiefly to American literature; and Chaucer, Spenser, and Milton are put in the last year. In

English poetry, except for dislocations due to difficulty (as in Chaucer, Spenser, and Milton), or to unquestioned supremacy (as in Shakespeare), the order is roughly chronological, the Classical School coming in the second year, the Romantic School in the third, and the Victorian School in the fourth. For the sake of variety, some novels and some essays are given to each year. As already stated, the list is neither prescriptive nor proscriptive, but suggestive. The only suggestion that the writer cares to offer concerning the selection of books from any one of these years is this: those books should be chosen that are best adapted to arouse in the particular class a love of the best literature. At least four such classics, it is thought, should be taken up in class a year.

But aside from the class-room reading and study of the masterpieces, the high-school student should do much supplementary reading, some under direction and some at his own will. He should read, say, at least four books a year, and should occasionally make written reports thereon. The books for this supplementary reading may be chosen from the books on the "Graded List of Classics," that have not been set apart for class-room use (in reading or in study), or from the appended "Graded List of Books for Supplementary Reading," or from both, or from whatever source may seem wisest to the teacher. With only a few modifications (duly noted), the "List of Books for Supplementary Reading" is that prepared and published by the National Educational Association in 1899.

Intelligent class-room study and general reading alike will be impossible without a small but well selected school library; and superintendents, principals, and teachers are urged to make every effort to secure such a library immediately.

Bibliography.

1. Text-Books Suitable for High Schools:

(a) Histories of English Literature: Halleck's *English Literature* (A. B. C.); Moody and Lovett's *A First View of English Literature* (Scribners); Newcomer's *English Literature* (Scott); Pancoast's *Introduction to English Literature* (H.); Simonds's *A Student's History of English Literature* (Ho.).

(b) Histories of American Literature: Bronson's *American Literature* (Heath); Newcomer's *American Literature* (Scott);

Pancoast's *Introduction to American Literature* (H.); Pattee's *A History of American Literature* (Silver).

(c) Texts: The Riverside Literature Series (Ho.); The Lake English Classics (Scott); The Students' Series of English Classics (Leach); Longmans' English Classics (Longmans); Macmillan's Pocket Classics (M.); English Readings (H.); Standard English Classics (G.); Gateway Series of English Texts (A. B. C.); Heath's English Classics (Heath); Palgrave's *Golden Treasury of the Best Songs and Lyrics in the English Language* (various publishers), and the "second series" of the same (M.); Syle's *English Poems from Milton to Tennyson* (Al.); Scudder's *American Poems* (Ho.); Weber's *The Southern Poets* (M.); Trent's *Southern Writers* (M.).

2. Books for the Teacher and for Reference:

(a) History of English and American Literature: Ten Brink's *Early English Literature,* 2 vols. (H.); Brooke's *Early English Literature* and *English Literature from the Beginning to the Norman Conquest* (M.); Schofield's *English Literature from the Norman Conquest to Chaucer* (M.); Saintsbury's *Elizabethan Literature, Nineteenth Century Literature,* and *A Short History of English Literature* (M.); Gosse's *Eighteenth Century Literature* (M.); Brooke's *English Literature* (M.); *Taine's English Literature* (H.); Richardson's *American Literature,* 2 vols. (Putnams, New York); Trent's *American Literature* (Ap.); Stedman's *American Poets* and *Victorian Poets* (Ho.); Holliday's *History of Southern Literature* (Neale Publishing Co., New York).

(b) Biography: The English Men of Letters Series (M.); The Great Writers Series (Walter Scott), to each volume of which is appended a bibliography; Modern English Writers Series (Dodd, Mead, & Co.); Sidney Lee's *Life of Shakespeare* (M.); Stephen's *Dictionary of National Biography* (36 vols., M.); American Men of Letters Series (Ho.).

(c) Literary Criticism: Winchester's *Principles of Literary Criticism* (M.); Cross's *The Development of the English Novel* (M.); Perry's *A Study of Prose Fiction* (Ho.); Moulton's *Shakespeare as a Dramatic Artist* (F.); Dowden's *Shakespeare; His Mind and Art* (Lemcke & Buechnêr, New York); Bradley's *Shakespearean Tragedy* (M.); Baker's *The Development of Shakespeare as a Dramatist* (M.); Brandes's *William Shakespeare: A Critical*

Study (M.); Freytag's *Technique of the Drama* (S. C. Griggs & Co., Chicago); Woodbridge's *The Drama: Its Law and Its Technique* (Al.); Stedman's *The Nature of Poetry* (Ho.); Gayley and Scott's *Methods and Materials of Literary Criticism* (G.), with a full bibliography; Brooke's *Tennyson: His Art and Relation to Modern Life* (P.); Brooke's *The Poetry of Robert Browning* (C.); Brooke's *Milton* (Ap.); Maynadier's *The Arthur of the English Poets* (Ho.).

(d) Texts: The Globe Edition of the Poets (M.); The Cambridge Edition of the Poets (Ho.); The Athenæum Press Series (G.); annotated editions of Shakespeare: Furness's (Lippincott, Philadelphia), Rolfe's (A. B. C.), Verity's (P.), Hudson's (G.), The Arden (Heath); Ward's *The English Poets* (4 vols., M.), the best anthology; Palgrave's *The Golden Treasury of the Best Songs and Lyrics in the English Language* (M.); Hales's *Longer English Poems* (M.); Manly's *English Poetry* (G.); Pancoast's *Standard English Poems* (H.); Stedman and Hutchinson's *Library of American Literature* (6 vols., The Century Company, New York); Stedman's *Victorian Anthology* and *American Anthology* (Ho.); Carpenter and Brewster's *Modern English Prose* (M.); Craik's *English Prose Selections,* 5 vols. (M.); Cook and Tinker's *Translations from Old English Poetry* (G.); Hall's *Beowulf* (Heath), or Child's *Beowulf* (Ho.), the former a metrical and the latter a prose translation, etc., etc.

(e) Dictionaries, etc.: Webster's *International* (Merriam, Springfield, Mass.); *The Century Dictionary* (The Century Company, New York); Gayley's *Classic Myths in English Literature* (G.); Adams's *Dictionary of American Authors* (Ho.); Ryland's *Chronological Outlines of English Literature* (M.); Whitcomb's *Chronological Outlines of American Literature* (M.); etc., etc.

3. Pedagogical Books: See 3 under Bibliography to Grammar.

Graded List of Classics for Reading and for Study.

First Year.

Bunyan: *Pilgrim's Progress,* Part I.
Franklin: *Autobiography.*
Irving: *The Sketch Book.*
Longfellow: *The Courtship of Miles Standish.*

Lowell: *The Vision of Sir Launfal.*
Macaulay: *Lays of Ancient Rome.*
Scott: *Ivanhoe, The Lady of the Lake, Quentin Durward.*
Shakespeare: *The Merchant of Venice.*
Washington: *Farewell Address** (see Burke under fourth year).
Webster: *Bunker Hill Oration** (see Burke under fourth year).

Second Year.

Addison: *The Sir Roger de Coverley Papers* in *The Spectator.*
George Eliot: *Silas Marner.*
Goldsmith: *The Deserted Village, The Vicar of Wakefield.*
Hawthorne: *The House of Seven Gables.*
Palgrave's *Golden Treasury* (First Series), Books II and III, with especial attention to Dryden, Collins, Gray, Cowper, Burns.
Poe: *Poems.*
Pope: *The Rape of the Lock.*
Shakespeare: *As You Like It, Julius Cæsar.*

Third Year.

Blackmore: *Lorna Doone.*
Byron: *Mazeppa, The Prisoner of Chillon.*
Carlyle: *Essay on Burns** (or Macaulay's *Life of Johnson*).
Coleridge: *The Ancient Mariner.*
De Quincey: *Joan of Arc, The English Mail Coach.*
Dickens: *A Tale of Two Cities.*
Mrs. Gaskell: *Cranford.*
Macaulay: *Life of Johnson** (or Carlyle's *Essay on Burns*).
Palgrave's *Golden Treasury* (first series), Book IV, with especial attention to Wordsworth, Keats, Shelley.
Shakespeare: *Henry V, Twelfth Night.*

Fourth Year.

Arnold: *Sohrab and Rustum.*
Bacon: *Essays.*
Browning: Select Poems (*Cavalier Tunes, Evelyn Hope, Hervé*

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* Throughout this list a star indicates that the book starred is recommended, by the various associations of preparatory schools and colleges, for more particular study; but the University of Texas prefers to leave the selection of such books to the individual teacher.

Riel, Home Thoughts from Abroad, Home Thoughts from the Sea, How They Brought the Good News from Ghent to Aix, Incident of the French Camp, One Word More, Pheidippides, The Boy and the Angel, The Lost Leader).

Burke: *Speech on Conciliation with America** (or Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*).

Carlyle: *Heroes and Hero Worship.*

Chaucer: *Prologue.*

Emerson: *Essays* (selected).

Lamb: *Essays of Elia.*

Milton: *Comus,** *Il Penseroso,** *L'Allegro,** *Lycidas.**

Ruskin: *Sesame and Lilies.*

Shakespeare: *Macbeth.**

Spenser: *Faerie Queene* (selections).

Tennyson: *Gareth and Lynette, Launcelot and Elaine, The Passing of Arthur.*

Thackeray: *Henry Esmond.*

Graded List of Books for Supplementary Reading.

First Year.

Aldrich, Thomas Bailey: *Story of a Bad Boy.*

Allen, James Lane: *Flute and Violin, and Other Kentucky Tales and Romances* (substituted for his *The Choir Invisible,* which latter is recommended by the National Educational Association).

Austin, Jane C.: *Betty Alden.*

Burroughs, John: *Sharp Eyes.*

Chesterfield, Lord: *Letters.*

De Amicis, Edmondo: *Cuore.*

Dana, Richard Henry, Jr.: *Two Years Before the Mast.*

Dickens, Charles: *Nicholas Nickleby.*

Dodge, Mary Mapes: *Hans Brinker.*

Franklin, Benjamin: *Autobiography.*

Grinnell, George Bird: *The Story of the Indian.*

Hale, Edward Everett: *Man Without a Country.*

Hawthorne, Nathaniel: *Wonder Book.*

Hawthorne, Nathaniel: *Tanglewood Tales.*

Hughes, Thomas: *Tom Brown at Rugby.*

Irving, Washington: *Sketch Book.*

Irving, Washington: *Life of Washington,* edited by Fiske.
Jewett, Sarah Orne: *Tales of New England.*
Kipling, Rudyard: *Jungle Book No. 1.*
Kipling, Rudyard: *Jungle Book No. 2.*
Lamb, Charles: *Tales of Shakespeare.*
Lincoln, Abraham: *Inaugural and Gettysburg Speech.*
Longfellow, Henry Wadsworth: *Tales of a Wayside Inn.*
Macaulay, Thomas Babbington: *Letters.*
Macdonald, George: *Back of the North Wind.*
Page, Curtis Hidden, Editor: *The Chief American Poets* (added).
Page, Thomas Nelson: *In Ole Virginia* (added).
Scott, Sir Walter: *Ivanhoe.*
Scott, Sir Walter: *Quentin Durward.*
Scudder, Horace E., Editor: *American Poems* (added).
Scudder, Horace E., Editor: *American Prose* (added).
Shakespeare, William: *Merchant of Venice.*
Trent, William Peterfield, Editor: *Southern Writers* (added).
Warner, Charles Dudley: *Being a Boy.*
Washington, George: *Rules of Conduct, Farewell Address.*
Weber, William Lander, Editor: *Selections from the Southern Poets* (added).
Webster, Daniel: *Bunker Hill Speeches.*
Whittier, John Greenleaf: *Snow Bound.*

Second Year.

Brown, Dr. John: *Rab and His Friends.*
Browning, Mrs. Elizabeth Barrett: *Lyrics and Sonnets* (*"Cry of the Children"*).
Chester, Eliza: *Girls and Women.*
Cooper, James Fennimore: *The Last of the Mohicans.*
Dickens, Charles: *Tale of Two Cities.*
Eggleston, Edward: *The Hoosier Schoolmaster.*
Fiske, John: *The War of Independence.*
Froude, James Anthony: *Julius Cæsar.*
Griffis, William Eliot: *Brave Little Holland.*
Hale, Edward Everett, Editor: Bulfinch's *Mythology.*
Hawthorne, Nathaniel: *Twice Told Tales.*
Irving, Washington: *Tales of a Traveler.*

Kaufmann, Rosalie: *Young Folks' Plutarch.*
Lake Poets: Wordsworth, Coleridge, Southey.
Lowell, James Russell: *Vision of Sir Launfal.*
Miller, Olive Thorne: *Little People of Asia.*
Mulock, Dina Maria: *John Halifax, Gentleman.*
Palgrave, Francis T., Editor: *The Golden Treasury of Songs and Lyrics* (added).
Plato: *Apology of Socrates.*
Pope, Alexander: Translations from the *Iliad* (Books I, VI, XXII, XXIV).
Preston and Dodge: *The Private Life of the Romans.*
Rolfe, William J.: *Shakespeare the Boy.*
Roosevelt, Theodore: *Ranch Life and the Hunting Trail.*
Roosevelt, Theodore, and Lodge, Henry Cabot: *Hero Tales from American History.*
Scott, Sir Walter: *Lady of the Lake.*
Scott, Sir Walter: *Marmion.*
Scott, Sir Walter: *Kenilworth.*
Shakespeare, William: *Julius Cæsar.*
Stockton, Francis Richard: *Rudder Grange Stories.*
Warner, Charles Dudley: *Backlog Studies.*

Third Year.

Arnold, Matthew: *Critical Essays.*
Blackmore, Richard Doddridge: *Lorna Doone.*
Church, Alfred John: *Roman Life in the Days of Cicero.*
Craddock, Charles Egbert: *The Prophet of the Great Smoky Mountains.*
Curtis, George William: *Prue and I.*
Dickens, Charles: *Dombey and Son.*
Dryden, John: *Palamon and Arcite.*
Ebers, Georg: *Uarda.*
Eliot, George: *Silas Marner.*
Emerson, Ralph Waldo: *Essay on Friendship.*
Fiske, John: *Political Ideas.*
Goldsmith, Oliver: *Vicar of Wakefield.*
Hawthorne, Nathaniel: *Our Old Home.*
Henty, George Alfred: *Wulf the Saxon.*
Henty, George Alfred: *The Young Carthaginian.*

Holmes, Oliver Wendell: *Autocrat of the Breakfast Table.*
Irving, Washington: *Legends of the Alhambra.*
Kingsley, Charles: *The Roman and the Teuton.*
Lowell, James Russell: *Critical Essays.*
Macaulay, Thomas Babington: *Lord Clive.*
Milton, John: Minor Poems.
Milton, John: *Paradise Lost* (Books I and II).
Palgrave, Francis T., Editor: *The Golden Treasury of Songs and Lyrics,* Second Series (added).
Phillips, Wendell: *Lectures and Speeches.*
Shakespeare, William: *Richard II.*
Shakespeare, William: *Twelfth Night.*
Shakespeare, William: *Macbeth.*
Stevenson, Robert Louis: *Kidnapped.*
Thackeray, William Makepeace: *The Newcomes.*
Wallace, Lew: *Ben Hur.*
Winthrop, Theodore: *John Brent.*

Fourth Year.

Addison, Joseph: *Sir Roger de Coverley Papers* in *The Spectator.*
Austen, Jane: *Pride and Prejudice.*
Black, William: *Judith Shakespeare.*
Bryce, James: *American Commonwealth* (abridged).
Burke, Edmund: *Speech on Conciliation with America.*
Carlyle, Thomas: *Essay on Burns* (with *Poems* by Burns).
Chaucer, Geoffrey: Selections from *The Canterbury Tales,* done into Modern English by W. W. Skeat, several volumes (added).
Coleridge, Samuel Taylor: *Rime of the Ancient Mariner.*
Dickens, Charles: *David Copperfield.*
Ebers, Georg: *Egyptian Princess.*
Emerson, Ralph Waldo: *Conduct of Life.*
Emerson, Ralph Waldo: *Essay on Manners.*
Eliot, George: *Romolo.*
Fiske, John: *Critical Period of American History.*
Fiske, John: *The Destiny of Man.*
Gaskell, Mrs. Elizabeth: *Life of Charlotte Bronte.*
Hawthorne, Nathaniel: *The Marble Faun.*
Macaulay, Thomas Babington: *Warren Hastings.*

Macaulay, Thomas Babington: *Milton* and *Addison.*

Mackenzie, Robert: *The Nineteenth Century.*

Palgrave, Francis T., Editor: *The Golden Treasury of Songs and Lyrics* (added).

Riis, Jacob August: *How the Other Half Lives.*

Ruskin, John: *Sesame and Lilies.*

Schurz, Carl: *Abraham Lincoln.*

Shakespeare, William: *Hamlet.*

Spencer, Herbert: *On Style* (Part I).

Tennyson, Alfred: *The Princess.*

Tennyson, Alfred: *Enoch Arden, The Idylls of the King* (both added).

Thackeray, William Makepeace: *Henry Esmond.*

Thoreau, Henry David: *Walden.*

Warner, Charles Dudley: *My Summer in a Garden.*

Winter, William: *Shakespeare's England.*

HISTORY AND CIVICS IN THE HIGH SCHOOL

(The following units may be offered:
Ancient History, 1 unit.
Mediæval and Modern History, 1 unit.
English History, 1 Unit.
American History, ½ or 1 unit.)

History should be so taught in the high school as to assist in developing in the students an intelligent insight into the nature and significance of the national life. They should be trained to look behind the tales full of human interest that drew them towards the subject in the lower grades, and study it rather as a process of political and social evolution which goes on naturally and is theoretically capable of scientific explanation in all its aspects. Above all things, they should be led to cultivate the habit of organizing the details of the information they gather into a systematic body of knowledge, capable of control and use for the acquisition of more. Knowledge thus organized, whatever may be its subject-matter, is properly called science. That method of teaching any subject, from pure mathematics to literature, which strives to fill the memory with a chaotic mass of unrelated facts can not be too strongly condemned. Owing to the special difficulties that lie in the way of giving rational and complete organization to historical knowledge, the method in question is perhaps more mischievous in teaching history than almost anything else. It is of little use to the student to hand over to him, as it were, long lists of names and dates and bits of fragmentary information as to the public doings and experiences of men. He will never understand by the help of any such instruction the real collective life with which history deals.

The best means of organizing historical knowledge is the use of outlines, which ought to be as rigorously logical as they can be made. The divisions into periods and sub-periods ought to correspond to natural divisions of the historical process itself. For example, an outline of American history would have such main heads as the periods of Discovery and Exploration, of Colonization, of Inter-Colonial Wars, etc., not simply because this arrangement

will facilitate the work of teacher and student, but because the actual unfolding of the history was by just such stages or phases. Every new period brings into view a new set of social forces by which it is characterized and distinguished from others; but successive periods usually overlap, and their demarcation is often puzzling, because the new set of forces shows its influence before the old has ceased to work. The real problems of the scientific organization of history show themselves in outline making. They must be ranked, for intellectual difficulty, far above those of explaining a single action or event by establishing a certain consecution of facts. They require broad generalizing and fine discrimination. The high-school student may be prepared for the struggle with these problems that will come when he enters the university by judiciously directed exercises in the construction and criticism of outlines and summaries. An outline of the kind here meant is not simply a topical analysis of a text-book, but rather a logically arranged table of the units and sub-units that arise from resolving a process of historical evolution into its elements.

The use of the outline should be enforced by constant reviews that will keep it before the student's mind. This is the only way to save him from being overwhelmed by details, and to give him a sense of real fruitfulness in his efforts.

The teacher of history should also strive to vitalize his work. No student of the subject will ever develop genuine insight and full appreciation of the historical process until the past, as he studies it, takes on for him its old life. The more of its original concreteness and peculiar character he can restore, the better he will understand it. For this purpose he should avail himself, as far as possible, of whatever it has left to the world. Its dress, tools, and armor; its official, ecclesiastical, and social paraphernalia; specimens of its art; and above all its literature, wherein, more than in all else, appears the "very age and body of the time." Some of these materials, and especially extracts from the literature of special epochs, are available for work in the high school, and they should be used sufficiently to show the student their value and to stimulate his interest and historical imagination. Of course, no large proportion of time can be given to their study until the university is reached, but much will be lost if they are neglected altogether. There are now published in convenient form several

collections of extracts from the contemporaneous literature of the different periods of English and American history that might profitably be used for reference, or even as texts, in high schools. A few of the most available of these collections are as follows:

American History.

Hart, *Source Book of American History, for Schools and Readers.* (The Macmillan Co., New York, 1899.) One volume; 60 cents. Suitable for class use.

Old South Leaflets (Old South Meeting House, Boston); 133 or more numbers. Single leaflets, 5 cents; $4 per 100. Bound volumes (25 numbers), $1.50 per volume.

American History Leaflets. (Lovell & Co., New York.) More than 30 numbers; 10 cents a copy.

English History.

Kendall, *Source Book of English History.* (The Macmillan Co., New York, 1900.) One volume; 80 cents.

Colby, F. M., *Selections from the Sources of English History.* (Longmans, Green & Co., New York.) $1.50.

General History.

Munro, *A Source Book of Roman History.* (D. C. Heath & Co., Boston.) $1.

Robinson, *Readings in European History.* (Ginn & Co., Boston.) $1.50.

It is impossible to understand the history of a country without knowing its physiography and the development of its political geography. Civilization varies with the natural adaptabilities of the land, and almost every change of territorial limits is bound up with some crisis in national life. Therefore history necessarily presupposes a knowledge of physical geography, and includes diligent attention to historical. For this reason there should be constant reference to relief and epoch maps, and especially a free use of outline maps. It is not necessary, but is rather for historical purposes a waste of time, for the students to draw the outlines. Neither is it well for them to be trained merely to copy from a model before the eyes. They may begin with that, but should not stop with it. What they should be taught to do is to fill in on an outline

map, without a model, the boundaries and the main subdivisions of the country studied, at the principal epochs of its history.

It goes without saying that in history, as in any subject whatever, students should be trained to accuracy. No slipshod work should be allowed. It is impossible, of course, for any student to reproduce all the numerous and complex details of history from memory, but he should not be allowed to become so careless as not to correct himself constantly. The habit of inaccuracy should not be suffered to grow. One of the strongest evidences of inattention to this principle in the teaching of those students who enter the University is the frequent mispronunciation of proper names. If these names are Greek or Latin, there are a few simple and easily applied rules that will prevent error in most cases, and these should be learned and used constantly in dealing with ancient history. As to other names, students should be referred to some authority for their correct pronunciation, which should be always insisted on.

Text-Books.

For Ancient, Mediæval, and Modern History more or less satisfactory high-school texts will be found in the two-volume set of Myers (Ginn & Co.), or West (Allyn & Bacon); and for the History of England, the manual by C. M. Andrews, or the *History of England for Schools,* by Terry, is recommended. For American History, it is more difficult to find a satisfactory treatment. The available texts for high schools are generally marked by one of three defects: Inaccuracy, want of proper proportion and organization, and sectional prejudice. Some that are, on the whole and with these reservations, most available are Adams and Trent's *History of the United States,* Johnston's and Hart's *Essentials of American History.*

By way of conclusion, the attention of teachers is earnestly directed to three books devoted to the pedagogy of history. They are *A History Syllabus for Secondary Schools* (Heath, 1904), prepared by a special committee of the New England History Teachers' Association; Bourne (H. E.), *The Teaching of History and Civics in the Elementary and Secondary Schools* (Ginn, 1902); and Mace (W. H.), *Method in History, for Teachers and Students* (Ginn, 1898). These books contain valuable outlines of various

portions of the field of history, discussions of methods of teaching the subject, and lists of reference works adapted to high school use.

CIVICS.

(One-half unit may be offered.)

Closely related to history in the high school is Civics. In public schools especially, it is to be expected that strong emphasis will be laid on both; for the public school is an institution to promote the general welfare, and one of the principal ways in which it does this is by raising the standard of citizenship. The studies which contribute most directly to an intelligent grasp of the duties of the citizen are history and civics.

In the teaching of civics, two objects should be kept in view: One to give the student a practical knowledge of American political and social organization and of the functions of the citizen in relation thereto, and to purify and confirm his standards of civic righteousness; the other to set forth the connection of the subject with that of political and social science, as a body of theoretical knowledge to be sought after for its own sake. In either case, the teacher should not confine the work to an enumeration of the various officials or organs of government, nor a study of the constitutional and statutory provisions by which their authorities and duties are defined; he should seek also to familiarize the student, as far as possible, with the actual working of all parts of the governmental system, national, State, and local. This will be least difficult, of course, in the case of the local government, the machinery of which, whether for county, town, or city, is at hand and can be observed in its ordinary operation. For the State and national government, it is, in general, not practicable; and the best substitute for direct observation lies in vivid description. It is quite easy to disgust and alienate students by requiring them to memorize and repeat a mass of facts, whose significance they only half understand; but the same facts, when seen in their proper relations to each other and their actual places in an organized system—especially if it is by the student's own observation—become full of living interest. An hour or two spent with a county or city official in his office, or a visit to the city council in session, would go further towards helping students to understand the real nature of county or city government than whole days of study in a text-book.

MATHEMATICS IN THE HIGH SCHOOL

(Four units may be offered.)

The teacher of arithmetic in the graded or high school should have in mind two principal aims, namely, to impart a comprehension of the principles underlying the rules of computation and a high degree of *accuracy* in carrying out these computations on moderately large numbers. Although the accurate handling of complicated arrays of figures requires considerable practice—more than can be given and more than it is desirable to give in the ordinary school course—a systematic drill in oral and written work will, if judiciously employed, result in a high degree of accuracy in ordinary work.

Neat and *methodical* arrangement of all written work should be insisted upon. Students should be required to check subtraction by adding subtrahend and remainder, short divisions by multiplying divisor and quotient.

The teaching of rational arithmetic, *i. e.*, the principles underlying the rules of computation, requires careful handling. In fact, the demonstration of many of these rules should be deferred until a beginning is made in algebra. Thus the algorithm for finding the greatest common factor of two numbers or for extracting the square root is best deferred until algebra is begun. On the whole, a review of *rational* arithmetic during the first year's algebra would greatly improve the student's knowledge of both subjects. The time devoted to *practical* arithmetic is in many schools excessive, and an earlier beginning in algebra would be conducive to a better knowledge of the reasons underlying the rules of computation and to a greater skill in actual numerical work.

In the teaching of algebra, as in all mathematical instruction, processes, *i. e.*, an orderly deduction of theorems, and not memorizing should be the constant aim of the teacher.

Factoring should be taught by abundant drill, solution of quadratics should always be by "completing the square," and not by a formula. The relations connecting the roots and coefficients should be proved and frequently employed. The student should be drilled into an accurate practice in dealing with surds and rationalizing

processes. *Oral* drills in simple algebraic reductions should be freely used.

Geometry is perhaps the best and the worst taught of all the subjects in the high school. The principal defect in the teaching is that the structure of the various proofs is not carefully analyzed and explained. It should be pointed out to the student *why* a certain group of theorems must necessarily be invoked in proving a given theorem, *why* the drawing of certain auxiliary lines and planes are useful in the proof, and why others can not be; the *arrangement of the proof in separate steps each with its appropriate citation and in due logical order* should be insisted on. Figures should be accurately and neatly drawn. Drawing instruments suitable for the purposes can now be bought for a few cents. A set of carefully graded originals should be judiciously used, and in order that the less gifted pupils be not discouraged by tasks beyond their powers, the more difficult ones should be assigned only to the best students.

Before beginning the subject of strictly deductive geometry, an easy set of exercises in drawing, modeling, and paper folding, in which the student would become familiar with the figures about which he is to reason deductively at a later stage, would be most useful. The teaching of solid geometry is much easier and more effective if supplemented by the use of a few models, which any boy with the least mechanical turn can easily construct.

The teacher that can bring his pupils to feel that they have a mastery of their geometry, a feeling of confidence in the integrity of their own mental processes, has succeeded as a teacher of geometry.

In conclusion, a word may be said as to an important matter of detail:

One of the most effective methods not only of inspiring but of sustaining the learner's interest in geometry is to require each pupil to keep a notebook in which are entered *carefully* drawn figures and accurately worded proofs of originals, and such other theorems as may be deemed desirable. Such books should be inspected by the teacher, and be graded both for neatness and accuracy.

A. Arithmetic.

While the University of Texas does not require a formal examination in arithmetic, it is, of course, difficult for a student to take successfully any of the mathematical courses offered here without a sound knowledge of this subject. What is desirable is the power to analyze accurately original problems of moderate difficulty independently of formal rules, and the ability to perform the requisite numerical operations neatly, rapidly, and *accurately.*

The metric system should be taught thoroughly and independently of any of the other so-called systems. Much time can be wasted on the details of commercial arithmetic and in memorizing numerous tables of weights and measures. Many problems that properly belong to algebra are often solved by arithmetic.

B. Algebra.

(One and one-half units.)

Facility and accuracy in factoring, in the reduction of fractional forms, with the ability to handle expressions involving fractional indices and radical signs, are the foundation for any attainment in algebra. This is what may be called the calculation side. Good results can only be obtained here by abundant drill, both written and oral. The students should be able to find the highest common factor and lowest common multiple of factorable expressions by the factor method; should be able to form and solve simple equations of the first degree in one, two, three unknowns; should be able to solve any quadratic, and determine, on *inspection,* the sum and product of the roots as well as decide concerning their reality; or, if the roots of the quadratic are given, should be able to write down the quadratic satisfied by them.

Since algebraic expressions represent certain arithmetic operations to be performed on certain numbers usually represented by letters, the student should be able to determine when these operations are possible, and should be taught frequently to test his calculation by substituting particular numbers for the letters involved. Students are prone to make erroneous inductions unwarranted by any principles of calculation. Faults of this sort should be drastically penalized, and the student should be taught to avoid them by checking his results by replacing the letters by particular

numbers. The difference between identities and equations should be familiar, and the *equivalence* of equations should receive careful attention.

Such topics as undetermined coefficients, and the binomial theorem, except for positive integral exponents, should be excluded from any high-school course. The above requirements are fairly represented by the first twenty chapters of Wentworth's *Elementary Algebra,* edition of 1906, or by the first fourteen chapters of Beman and Smith's *Elements of Algebra,* together with pp. 390-4 of the appendix.

C. Plane Geometry.

(One and one-half units.)

For entrance the University requires a detailed knowledge of the most important theorems of the first five books. This implies a precise knowledge of the definitions of the fundamental geometrical figures and concepts, such as angle, circle, polygon, congruence, length, area, equivalence, locus, etc., and an appreciation of the nature of a geometrical *proof.* The structure of various types of proofs should be understood, *i. e.,* the usual procedure in a superposition proof, an indirect proof, or a locus proof. The comprehension of such proof is greatly facilitated by separating the proof into its various steps, each step characterized by a citation to a definition, an axiom, a previous theorem, or a part of the hypothesis.

In the teaching of deductive geometry a most valuable auxiliary is the judicious use of a well-arranged set of original exercises. The teacher should point out the principles which guide in the selection of proper auxiliary constructions, and should lead the student to find such construction for himself by a process of intelligent experiment.

With average students much better results are gotten if the deductive geometry be preceded by a few months' work in concrete geometry, where the pupils get clear and concrete notions of the fundamental figures and concepts of geometry by drawing, paper-folding, and measurement. A great many pupils fail to learn geometry because they have no clear notion of what the technical terms of this subject mean. It is in clarifying such notions that the concrete geometry is most useful.

D. Solid Geometry.

(One-half unit.)

To absolve the entrance requirements in solid geometry, it is necessary to present books 6, 7, 8, 9 of the usual arrangement, omitting conic sections. The student should be thoroughly familiar with the properties of parallel and perpendicular lines and planes and well grounded in the theorems concerning polyhedrons.

The time spent on the first two books should exceed somewhat the time spent on the last two.

The last book should be accompanied by numerous exercises in *calculation* in which accuracy is insisted on.

A few models of the more important solids are helpful in shaping the space intuition of the student, and fairly accurate perspective drawing of figures is desirable.

Logical completeness in proofs should be even more thoroughly insisted on here than in the plane geometry, when the student's feeling of logical completeness is less developed than at this later stage.

E. Plane Trigonometry.

(One-half unit.)

The plane trigonometry required for entrance is the amount given in most of the texts in common use, and includes identities in two or more letters, solution of triangles, solution and discussion of simple trigonometric equations and circular measure of angles. The student should be able to construct an angle from any given function and solve triangles by measurement, by means of calculation with natural functions, and finally by calculations with tables of logarithms. His arithmetic work should be accurate, and he should be taught to use simple checks to test the accuracy of his work independent of the answers in the book. The first work in solving right triangles should be with the use of natural functions and never with the logarithms of such functions.

The fundamental identities should be carefully *memorized* and their demonstration familiar, but the general induction proof for the addition formulæ $\sin(xy)$ $\cos(xy)$ might be omitted with advantage, only the proofs for x and y both acute being given. The

student should be so instructed that he knows the subject independently of his text. On examinations and all other tests the only book allowed should be a table of natural and logarithmic functions.

LATIN IN THE HIGH SCHOOL

(Three or four units may be offered.)

The minimum preparatory course now required for entrance to The University of Texas embraces:

1. Grammar.
2. Prose composition.
3. Translation:
   (a) *Viri Romae,* or other introductory Latin.
   (b) Cæsar, three books.
   (c) Cicero, *Manilian Law,* and two other orations.*
   (d) Vergil, *Aeneid,* Book I.
4. Scansion, the dactylic hexameter in connection with the *Aeneid.*

The following suggestions may be made touching instruction in these subjects:

1. *Forms and Pronunciation.*†—Nothing is so important at first as the mastery of the forms. In the first year the student should learn, not only to recite, but also to write his forms, always marking the quantities and the accents, and dividing the syllables. He should be cautioned that when text-books write *hom-in-is* and *am-av-ero,* it is to teach the stem formation, while *ho-mi-nis, a-ma-ve-ro* represent the only correct syllable division. It will not be useless even to indicate "length-by-position" by drawing a line under the two consonants that give position, as in the following words: *a-spec-tus, de-spec-tus, a-gri* or *a-gri* (genitive to *a-ger*), but only *a-cris* (genitive to *a-cer.*) The correct placing of the accent is to be insisted on: a student might be pardoned for not knowing the quantity of the syllable *na-* in *na-tu-ra,* but it is inexcusable not to know that *-tu-,* the accented penult, is long, or that *-ra* is short, if a nominative, but long, if an ablative; it is inexcusable to pronounce *éadem* (nom. sg. fem. and nom. plur.

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*Teachers generally choose two of the *Catilines.*

†Pronounce ă as in Cuba, ā as in far; ĕ as in met, ē as in fête; ĭ as in pin, ī as in machine; ŏ as in not, ō as in note; ŭ as in full, ū as in rude; au=ou in house, oe=oi in boil ui=we. The digraph qu=one consonant, and y=i.

neut.) like *eadem* (abl. sg. fem.). The most important quantities are, of course, those that characterize the case, the mood and tense, person and number of Latin words: this constitutes,—nothing short of this does constitute,—a knowledge of the forms.

In brief: The student should acquire once for all from his introductory book a lasting knowledge of all the forms he has met, and in all his subsequent reading and grammar work this knowledge of the forms must be kept alive. Similarly a correct pronunciation once acquired must never become slovenly. This will demand much reading aloud on the part of both student and teacher, and I suggest that every reading lesson be reviewed as follows: The teacher to read aloud the review intelligibly, phrase by phrase, and the pupil to render this by ear, not having his text open before him. To secure exact results in all form-work, the teacher will need to make much use of the blackboard, and correct many written tasks.

2. *Syntax.*—The subject of syntax in any good elementary Latin book is introduced piecemeal, one or two principles at a time, till the leading points are all presented. By the time the student begins Cæsar he should be able to distinguish between main and dependent clauses and to group them in some graphic way by a simple diagram system.

3. *Prose Composition.*—Writing Latin is the very best means to learn the language: "Writing maketh an exact man." Writing should be started almost from the beginning, first as a means of teaching forms, quantity, and accent, and then for the sake of syntax. By the second year writing should have at least one weekly period devoted to it exclusively, and I would recommend about two short sentences to go with each reading lesson as well.

If the teacher prefers to use the method based on sentences drawn from the reading books of his class, besides older books of merit, he may choose the books of D'Ooge (Ginn & Co.), or Barss (University Publishing Co.). For the detached sentence plan—not neglected in the two books mentioned—one of the best books is Bennett's (Allyn & Bacon). Prose sentences should frequently be diagrammed in class.

4. *Translation.*—As to teaching translation, students ought to learn how to translate in written as well as in oral versions. Frequent exercises to acquire this power should be assigned. I would

suggest that at least once a month in the second and third years a passage of ten lines or such a matter be assigned for written translation. This might be rendered with bald literalness in one version, while in a parallel column genuine English might be called for. No better practice in English composition can be given than this, and by this means the enthusiastic Latin teacher might remove the reproach that the classics are not practically useful, when, in fact, if we take them diligently, they help to a very superior control of the mother tongue. The student has acquired some control not only of his powers of expression, but also of his thinking powers when he learns to render *Manlius Gallum caesum torque spoliavit,* not by (1) "Manlius spoiled the slain Gaul of his necklet," but by (2) "Manlius slew the Gaul and tore his necklet off." So *Manlius Gallo caeso torquem detraxit* should finally be rendered "M. slew the Gaul and took his necklet off." Similarly the student must not render *Manlius, stricto gladio, in Gallum invadit* by (1) "M. his sword having been drawn advanced upon the Gaul," but by (2) "M. having drawn his sword advanced, etc.," or by (3) "M. with drawn sword, etc." So, in idiomatic English, *forte aderat Caesar* is not (1) "Caesar was present by chance," but (2) "Caesar happened to be there."

Whether or not the student must needs pass through bald translations like those marked (1) before reaching the more idiomatic ones marked (2) is too large a question to discuss here; but no Latin teacher with a conscience sensitive to the duty and privilege of teaching English through Latin will ever let his pupil stop short of the ideals of translation presented in the versions marked (2).

5. *Scansion.*—In connection with the translation of the *Aeneid,* pupils should be taught the scansion of the dactylic hexameter. Teachers would do well before trying to scan the *Aeneid,* to read aloud Kingsley's poem of *Andromeda,* which will show in English the cadence of the hexameter. By the use of Gleason's *Gate to Vergil* (Ginn & Co.) the work in scansion would be greatly facilitated, but a teacher sure of his own accuracy in scansion will need no such makeshift.

I would now note a few of the shortcomings I have observed during my experience as an examiner of students in the last few years. They almost never know the constructions of intransitives;

thus they will write incorrectly *persuadeor* and not *mihi persuadetur* for the passive "I am persuaded"; and unconcernedly make the third person form of the verb do duty for the first or second, particularly in relative clauses. They are as apt to write *Appolo* as *Apollo; aedes Apollinaris* is "The Apollinaric house," or some such thing, not "The temple of Apollo"; *bellum Sertorianum* is not "the war with Sertorius," but always "the Sertorian war." These examples to caution teachers to set their faces earnestly against the young student's carelessness about proper names and adjectives. Such spellings as genative and accusitive exhibit the same carelessness. Why after two months' close association with *Catiline* will students spell Cataline? Students are slovenly, too, in not distinguishing between such words as *orior* and *ordior, reddo* and *redeo, quaero* and *queror, moror* and *morior, pario* and *paro* and *pareo.* Latin does not lack in words like these which demand of the student the most careful attention.

As interesting private reading, bearing on Roman life, *Quo Vadis, Last Days of Pompeii, Darkness and Dawn,* Macaulay's *Lays of Ancient Rome,* may be mentioned. Every high-school library should have, for the use of its Latin students, Harper's *Latin Dictionary* ($6.50, Am. Book Co.); Seyffert's *Dictionary of Classical Antiquities* ($3.00, Macmillan); Gow's *Companion to School Classics* (Macmillan). Other useful books are a classical atlas, Guhl and Koner's *Private Life of the Romans,* Schreiber's *Atlas of Classical Antiquities.*

The School of Latin has on file a record of all its students for some eight years past, showing just what preparation they (remember themselves to) have had. This record enables us to measure the strength of the Latin work in each high school from year to year, and often reveals a wide gap between the preparation the student has received and the course of study set forth in the catalogue of his school. Such gaps ought never to exist.

This is the place to say to the Latin teachers of Texas that the minimum Latin requirements at our State University are predicated on a diligent but not very exacting three years' preparatory course, and that this standard is a full year in time (in amount of ground covered more than a year) lower than the standard of admission actually enforced in some other good State universities. We ought gradually to raise our standard, not from any require-

ment on the part of the University, but because of the growth of our high schools. When our high schools shall determine that Texas courses of study shall be equal to the courses in Michigan and Illinois high schools, then the University must meet the demand by setting a higher entrance standard in Latin. Progress has already been made, and many of our schools are now giving four-year courses in Latin. The best of these should aim, by completing the full course of study to be presently mentioned, to secure four credits for the maximum entrance privilege in Latin.

Course Suggested for Affiliated Schools.

(The first three years of this course comprise the minimum entrance requirements. The fourth year adds enough more to secure four, instead of three, entrance credits. Many schools will do well to try and cover in four years, thoroughly the work laid down for three years.)

First Year.

1. Elementary Book. Lay especial stress on pronunciation, division of syllables, declensions by endings, conjugation by systems.
2. *Via Latina* (12 pp.), or some other easy Latin for practice in simple reading.

Second Year.

1. *Via Latina* (12 pp.), as a preparation for Caesar, to secure a review of forms and simple principles of syntax.
2. Caesar, *The Gallic War*. Books I-III.
3. Latin Exercises (Prose Composition); one lesson each week.

Third Year.

1. Cicero, (a) *The Manilian Law*; (b) two of the *Catilines*.
2. Vergil, *The Aeneid*, Book I.
3. Prose Composition, one lesson each week.

Fourth Year.

1. Cicero, *The Catilines*, III and IV.
2. Vergil, *The Aeneid*, II-IV.
3. Cicero, *Archias*.
4. Prose Composition, as in third year.

The study of Latin, acknowledged to be highly effective as a mental discipline, and contributory at every step to an improved knowledge of English, depends for its value on the efficiency of the instruction given. One can not teach Latin without knowing it, and unless one has enjoyed at least three years of Latin in a good high school and at least two years more of maturer work under competent teachers, preferably in a college, one may seriously question whether he "has a call" to teach Latin. On the other hand, experienced teachers, "apt to teach," who have enjoyed fewer advantages of special Latin training, would find themselves greatly benefited by taking two or more courses in the summer schools of The University of Texas.

The classical teachers of the University will esteem it a privilege to be of service at any and all times to the Latin teachers in the high schools.

GREEK IN THE HIGH SCHOOL

(Two or three units may be offered.)

Success in an undertaking is usually in proportion to the pains with which its object is kept in view. In the study of Greek, though incidentally we gain a great deal more, and ultimately we aim at a knowledge of Greek civilization, our primary aim is the ability to read Greek. According as one can read Greek with understanding and appreciation he is a Greek scholar. In the discovery of the means best adapted to secure this end lies the secret of teaching Greek.

To understand an inflected language a knowledge of three things is needful,—forms, syntax, the meaning of words. Without knowing forms, it is impossible to tell the relations of words; without knowing syntax we can not determine the structure of sentences; without knowing the meaning of words, we are manifestly helpless. To try to learn the three separately is fatal. From the start they should continually reinforce and supplement one another.

The acquisition of forms can be lightened by proper analysis and intelligent comparison with Latin, but, after all, it is largely a matter of memory. Constant drilling and frequent reviews are indispensable.

In syntax it is harmful to puzzle the student over queer or uncommon uses, either in the text read or in the grammar, but by every means at command, by question and explanation, by special grammar references and by systematic grammar study, by comparison with other languages, and, above all, by the writing of Greek sentences, the teacher must fix ineradicably the general principles that govern the construction of Greek sentences. Syntax is not studied for itself, though it affords an unrivaled mental drill, but because without it no real progress is possible in securing the power to read.

With most students of Greek, its vocabulary is a greater difficulty than forms or syntax. Nevertheless, rational methods greatly lighten the task. Association with cognates and derivatives in other languages, especially English, is one. Memorizing outright a small number of words every day and never losing them is another.

If told that a word occurs, say, sixteen times in the Anabasis, most students will think it a saving of labor to learn the word and be done with it. In this connection the word lists in Harper and Wallace's *Anabasis* (American Book Co.) are of much value.

Another plan, productive of excellent results, is the grouping together of words of the same origin and tracing their connection in meaning. Admirable examples of such groups are contained in the vocabulary to Goodwin and White's *Anabasis* (Ginn & Co.). Prefaced by lessons on the formation of words and explained by a skillful teacher, they are as interesting as profitable.

Better than all such means as these is the habit of self-dependence. Most of the words in a sentence the student can recognize at once. By an effort he can recall others. As to the uncommon words, by observation of their relation to the rest of the sentence as shown by their form, by examination of their formation, by use of the imagination, it is possible in most cases to arrive at what they must inevitably mean. To confirm such a judgment and fix the word in the mind, it is necessary to use the lexicon, and use it carefully. To turn to the lexicon without earnest effort at self-reliance is excellent finger exercise, but it is deadly to the mind.

Serviceable alike for forms and syntax and words is composition in Greek. As a drill in all these, nothing can take its place and there is no surer test of real scholarship. It is not an end in itself, but it necessitates a command as well of details as of general principles that is of inestimable help when applied to the reading of a Greek author. For the first year, Greek sentences should be written daily. During the second, at least one period a week should be devoted to composition. To write in the spirit of the Greek, and anything else is surely superfluous, it is necessary at first to imitate some good model. This model it is best, perhaps, to find in the text being read.

Hardly inferior to writing Greek as a means of learning the structure of sentences and in the cultivation of a feeling for style is the reading of Greek aloud. It is a great help, too, in forms and pronunciation, teaching by ear as well as by eye. For the first two years, it is well always to read the day's passage aloud, either before or after the translation, but never without expression. We do not, or should not, read English as if it were meaningless. Why, then, read Greek sentences like lists of words in a vocabulary?

Reading in concert is useful, the teacher with proper emphasis reading a clause first, the class then reading in unison after him, slowly and distinctly, every member making himself heard. A class once accustomed to this can read together without trouble, the teacher leading with a strong voice, but not giving out the passage clause by clause as before. In poetry, of course, this is easier than in prose, and even more profitable. There is no surer way to learn the measured flow of the verse or to gain a correct idea of time. Still, reading in concert does not permit of the finer expression of meaning demanded in individual reading. To this it but paves the way.

If such a thing were possible, it might be well to dispense with translation entirely. Unfortunately, teachers, being seldom mind-readers, are forced to ask their pupils to translate in order to find out whether they understand what they read. Yet translation is profitable for other reasons also. It is a capital drill in clearness and elegance of expression in English. That is, if it be really translation. Perfect translation is rendering the thought of one language into another, without loss, without addition, in a style reproducing the characteristics of the original. This requires in the translator a genius akin to that of his author. He must have perfect knowledge of the other's language and perfect facility in his own. We may not succeed in becoming expert translators, but it is worth while to try. From the first day to the last, the good teacher will never tolerate bad English. His own renderings being irreproachable, he will insist upon idiomatic, if possible elegant, English from his students. Literal translation can not be either. It results in that horrible translation lingo that is justly the great reproach of classical teaching. Of course a passage must be understood before it can be translated. This once secured, it makes little or no difference how "free" the rendering is. If it gives all the thought of the original, and no more, in an appropriate English style, it is a good translation.

Let the work begin with an introductory book that is not too hard. The more recent ones are White (Ginn & Co.), Ball (The Macmillan Co.), Gleason (American Book Co.), Morrison and Goodell (D. Appleton & Co.), Benner and Smyth (American Book Co.), Burgess and Bonner (Scott, Foresman & Co.). Each lesson should be mastered. From the beginning, accuracy is essen-

tial. Errors uncorrected produce slipshod habits. The teacher himself will be scrupulously accurate always.

In the sounds of the letters, it is best to follow the rules as given in the books above named. They embody the best American usage. Let the words be pronounced always with the principal stress on the accented syllable. This is not what accent meant to the Greeks, but it is the best we can do.

It is pleasant to vary the work of the introductory book with the reading of a collection of easy stories like Moss's *Greek Reader* (Allyn & Bacon). Short, attractive stories, such as these, stimulate the student to read them for their own sake.

After the introductory book and the easy reader come the Anabasis, grammar, and composition book. Goodwin and White's *Anabasis* (Ginn & Co.), has many advantages. Kelsey and Zenos (Allyn & Bacon), Harper and Wallace (American Book Co.), are both popular. C. F. Smith's (D. Appleton & Co.) is new and good. Between the two most popular grammars, Goodwin (Ginn & Co.) and Hadley-Allen (American Book Co.), there is little to choose. Babbitt's (American Book Co.) is remarkably simple and clear. Goodell's *School Grammar of Attic Greek* is a scholarly effort "to aid in meeting the legitimate demand for better results from the time and labor expended." Composition books are almost as numerous as introductory books. Woodruff, Harper and Castle (American Book Co.), Collar and Daniell (Ginn & Co.), Pearson (American Book Co.), Bonner (Scott, Foresman & Co.), are all constructed on the imitation theory, the exercises being based on passages from *Xenophon,* chiefly the *Anabasis.*

In a good school, the first year's work of five forty-five minute periods a week will include the introductory book and the whole of a book of stories like Moss's; or, if the stories be not read, the first book of the *Anabasis,* except the ninth chapter. The second year, also of five three-quarter hour periods a week, is long enough for the first four books of the *Anabasis,* besides composition. If only three books can be read, let them be the first, third, and fourth. The fourth is much more interesting than the second. Homer it is better to postpone to the third year, if the curriculum include one; or to the University. Nobody has a right to begin Homer without a thorough grounding in Attic prose.

In the work of the first years in Greek the learning of new

forms is tiresome, and the strange vocabulary is an ever-present stumbling block. It is the teacher's part to smooth the way. Let things never drag. "Snap," combined with unfailing patience and sympathy, goes a long way to make the student enjoy his class hours and carry the interest to his study.

Then, too, sidelights from history, mythology, art, public and private antiquities, will carry a class over many a hard place, and may kindle an unexpected enthusiasm. After all, the ideal of classical scholarship is a knowledge of classical civilization, and though language and literature are now our chief concern, they are not all we have to guide us.

Moreover, there should be pictures illustrative of classical art and scenery, the more the better. They are cheap now and wonderfully good. Let there be a plaster cast or two—the Aphrodite of Melos and the Hermes of Praxiteles, first of all. The unconscious influence of such things is strong not only in rousing an interest in things Greek, but in creating a refined taste in general. Next to wall pictures and casts, lantern slides give best results. A good lantern can be had for $25, and excellent slides for thirty cents apiece. If the teacher be a clever workman, he can make them himself for less.

Better than sidelights from the teacher is what the student finds out for himself. Let him have access to the proper books and be taught how to consult them. Every school should have at least the nucleus of a classical library. Among the books first bought should be a history of Greece (Botsford: The Macmillan Co., $1.25; or Oman: Longmans, Green & Co., $1.20; or Myers: Ginn & Co., $1.25), a classical dictionary (Smith, revised by Marindin: D. Appleton & Co., $5.00), a dictionary of antiquities (the new Smith, revised and shortened by Cornish: H. Holt & Co., $4.00, or Seyffert: The Macmillan Co., $3.00), a classical atlas (Kiepert: Rand, McNally & Co., $3.00; or Murray's, Oxford University Press, $1.50), a manual of Mythology (Gayley: Ginn & Co., $1.50, or Bulfinch: T. Y. Crowell & Co., 75 cents, or Murray: C. Scribner's Sons, $1.25); a history of Greek Art (Tarbell: The Macmillan Co., $1.25; or Wallers's *Art of the Greeks:* The Macmillan Co., $6.00); a history of Greek Literature (Jevons: C. Scribner's Sons, $2.50, or Fowler: D. Appleton & Co., $1.40, or Mahaffy: The Macmillan Co., $4.00). Besides these there should be

Schreiber's *Atlas of Classical Antiquities,* translated by Anderson (The Macmillan Co., $8.00), Gardner and Jevons's *Manual of Greek Antiquities* (C. Scribner's Sons, $4.00), Gulick's *Life of the Ancient Greeks* (D. Appleton & Co., $1.40), T. G. Tucker's *Life in Ancient Athens* (The Macmillan Co., $1.25), Goodwin's *Greek Moods and Tenses* (Ginn & Co., $2.00), and Liddell and Scott's *Greek-English Lexicon* (The American Book Co., $10.00).

In all his work the teacher will remember that his primary object is to teach the student to read Greek. Everything else is subsidiary to this. The true teacher will know what is essential and what is not; what must be stressed and what passed lightly over; yet he will not forget that "haste makes waste," and that the fruit of carelessness is muddy thinking.

MODERN LANGUAGES IN THE HIGH SCHOOL

INTRODUCTORY.

It seems generally agreed today that the modern languages deserve a place in the high school curriculum.

They have the disciplinary value which is inherent in all linguistic studies, and they serve as an introduction to the life and literature of the most important nations of modern Europe.

There exists, however, considerable diversity of opinion as to the best method of teaching these languages. To a certain extent this difference of opinion is a real one. But largely it results from a misconception as to the true aims of modern language instruction, or, at any rate, from a lack of agreement as to their relative importance, and from the failure to take into account the special conditions with which every teacher has to deal.

There does not exist one right method which must or may be applied under all circumstances. It is obvious, for example, that if the modern language is regarded primarily as a means of training, the teacher may be justified in laying special stress on the grammar, but that if his aim is to impart facility in reading, he may deem a little grammar sufficient for that purpose. Again, if one would learn to speak a language, grammar and reading may prove of great assistance, but they are not sufficient. Further, the age of the pupils, their knowledge of other languages, the size of the class, the length of the course, and his own equipment, must be considered by the teacher in determining both what is legal shall be and how he shall attempt to reach it. Nor is it a matter of indifference whether the student is likely to continue the study of the languages after leaving the high school, and whether he is likely to have occasion to use this language, and, if so, whether in its written or in its spoken form.

It follows that it is difficult to give specific directions, and the outlines below, although they have been made as definite as possible, must be regarded largely in the light of suggestions.

It must not be overlooked, however, that in the controversy which has been waged on the subject of methods in modern language instruction, certain principles seem to have been clearly

established, and no teacher is to be pardoned who fails to acquaint himself with these. In this connection, teachers are urgently requested to consult the *Report of the Committee of Twelve of the Modern Language Association of America,* published by D. C. Heath & Co. (price 16 cents), a remarkably clear and fair discussion of the ideals and methods of modern language instruction. The following books will also prove instructive: *Methods of Teaching Modern Languages* (D. C. Heath & Co.); *A Practical Study of Languages,* by Henry Sweet (Henry Holt & Co.); *How to Teach a Foreign Language,* by Otto Jespersen (The Macmillan Co.); *The Teaching of Modern Languages,* by Leopold Bahlsen (Ginn & Co.).

GERMAN.

(Two or three units may be offered.)

The following suggestions are offered as indicating the kind of preparation required in German for admission to the University.

The pronunciation is a matter of primary importance for the beginner. Constant drill should be kept up until right habits are firmly fixed. It will be necessary to train both the ear and the vocal organs of the learner; oft repeated imitations of a good pronunciation are the only sure means of acquiring an approximately accurate pronunciation. A knowledge of phonetics is an invaluable aid to the teacher in correcting faults, for it enables him to see the difficulty of the pupil and help him to overcome it.

A thorough drill in the idioms acquired by the memory and frequent repetition of colloquial sentences is highly recommended. The teacher can easily improvise exercises for drill in idioms by noting down suitable sentences from the reading.

Grammatical forms should be dwelt upon until they become second nature. Let the teacher concentrate upon those words that belong to the language of everyday life and make sure of these. The rest will follow without effort. Useful hints on teaching German will be found in *The Report of the Committee of Twelve of the Modern Language Association of America; Methods of Teaching Modern Languages* (Heath); *Practical Study of Language,* by Henry Sweet (Holt).

The work of the first and second years should consist mainly in drill on forms, on modern German idioms, on word-order,

sentence-structure (very slightly). Reading should be begun as early as possible and drill in pronunciation connected with it. Grammars containing good idiomatic colloquies are best suited for these years, as the pupils will thus get the best idioms of the German with a knowledge of grammar and the vocabulary.

In the third year (and fourth, if given), reading and composition should be stressed. Style and sentence structure should receive the greatest attention and conversation may be begun or continued. The reading should be selections from the best prose, dramas, and histories. *Minna von Barnhelm and Wilhelm Tell* may be read as an introduction to the classics.

For the guidance of the teacher the following three years' course in German for preparatory schools is suggested.

First Year.

First Half.—Grammar (for the Natural Method): Bernhard's *Sprachbuch I* (Schoenhof); (for the old method), Collar-Eysenbach (Ginn), Spanhoofd (Heath), *Beginning German,* by H. C. Bierwirth (Holt), *German Grammar,* by Paul V. Bacon (Allyn & Bacon). Reading: *Märchen und Erzählungen,* by Guerber (Heath), any of the many readers, or any collection of short stories, 40 to 50 pages.

Second Half.—Grammar: Joynes-Meissner (Heath), Thomas (Holt), *Elements of German,* by H. C. Bierwirth (Holt), Reading continued, 50 to 75 pages.

Second Year.

First Half.—Grammar: Bernhard's *Sprachbuch II,* or Collar-Eysenbach, or Spanhoofd, or Bierwirth, or Bacon, continued. Reading as above, continued, 75 to 100 pages.

Second Half.—Joynes-Meissner, or Thomas, or Bierwirth, continued. Reading of easy prose pieces or easy plays, 100 to 150 pages.

Third Year.

First Half.—Grammar: Alternate exercises to Joynes-Meissner, or Hervey's *Supplemental Exercises to Thomas,* or the more difficult exercises in Bierwirth's *Elements of German.* Reading: Short stories or more advanced plays, 125 to 175 pages.

Second Half.—Joynes-Meissner II, Thomas II, Bierwirth (Syntax). Reading: *Minna von Barnhelm, Wilhelm Tell,* or more difficult prose pieces, 150 to 200 pages.

FRENCH.

(Two or three units may be offered.)

First Year.

I.—Grammar and Composition: Careful drill in prenunciation and in the rudiments of grammar, including the conjugation of the regular and a few important irregular verbs, the forms and the most important uses of the various classes of pronouns, the chief rules for the inflection of nouns and adjectives and for the agreement of adjectives and participles, the use of the partitive and generic articles, and the word order in the sentence. Exercises should be written frequently. The written accent is as important as any other element of spelling.

Dictations and oral practice, based on the reading and on the exercises, are invaluable.

From the many text-books available it is hard to make a choice. Possibly Downer's *First Book in French* (Appleton & Co.) and Newson's *First French Book* (Newson & Co.) may be recommended as good books illustrating different methods of approach. Indeed, these two books might profitably be used to supplement each other. In the case of the former the teacher will doubtless not consider it always desirable to follow the order of the book.

II.—About 150 pages should be read. Suitable text-books are: Malot's *Sans Famille* (Heath); Erckmann-Chatrian's *Waterloo* (Holt); Jules Verne's *L'Expedition de la Jeune Hardie* (Heath); any one of the many readers available, etc.

Second Year.

I.—Grammar and Composition: Continued drill in the elements of grammar, including the subjects mentioned under "First Year," to be studied now in greater detail, all the important irregular verbs, the most important uses of the tenses of the indicative, the most important uses of the conditional, subjunctive, and infinitive, and of prepositions, adverbs, and conjunctions. Perhaps by the end of the second year the student should have gone

over the ground covered in Downer's *First Book in French* (all the exercises need not have been written).

Dictation, oral practice, and reproduction are of the greatest importance.

II.—Possibly 250 pages may be read in this year. Suitable texts are: About's *Le Roi des Montagnes* (Heath); Daudet's *Le Petit Chose* (Heath); Labiche et Martin's *Le Voyage de M. Perrichon* (Ginn); Merimee's *Columba* (Holt); etc.

Third Year.

I.—Grammar and Composition: By the end of the third year the student should have finished a grammar of moderate completeness, such as Edgren's *Compendious French Grammar* (Heath), or Fraser and Squair's *French Grammar* (Heath), although his attention should still be directed mainly towards the important topics.

Reproduction of passages read or heard, as before; oral practice; dictation.

II.—About 350 pages may be read from the following texts: Hugo's *La Chute* (Heath); Maupassant's *Ten Short Stories* (Ginn); France's *Le Crime de Sylvester Bonnard* (Holt); etc.

All exercises should be carefully corrected by the teacher. Texts should be selected from nineteenth century authors; preferably fiction, with one or two plays in the second and third years.

The above lists of texts for reading are intended to be suggestive only.

SPANISH.

(Two or three units may be offered.)

First Year.

I.—Grammar:

Complete an elementary grammar, *e. g.* Loiseaux's (Silver, Burdett & Co.), Edgren's (D. C. Heath). Knoflach's *Spanish Simplified* (University Pub. Co., New York), or Marion & Des Garennes' *Introducción á la Lengua Castellana* (D. C. Heath).

Exercises to be carefully written and corrected. Careful drill on the forms and uses of the various classes of pronouns: personal, possessive, relative, demonstrative, and interrogative. Without too much insistence on special rules, pay careful attention to *written*

accent. Pay careful attention to position of the adjective and its agreement with the noun.

Verbs should be covered as follows: The three regular conjugations, *ser, estar, tener;* and *haber* with compound tenses. Without insistence on *why* changes take place, verbs, of the *volver, pensar* classes should be learned. A few irregular verbs. Oral drill.

II.—Dictation and as much oral work as possible, based on reading and exercises.

Texts suitable for reading in beginners' course: Ramsey's *Spanish Reader* (Henry Holt & Co.); Worman's *First and Second Readers; Second and Third Spanish Readers* (Silver, Burdett & Co.); *Doce Cuentos Escogidos* (W. Jenkins & Co.); Pinney's *Spanish Conversation,* two parts (Ginn & Co.).

Second Year.

I.—Grammar:

Hills and Ford's *Spanish Grammar,* through lesson—

Work on the pronouns specially; on the subjunctive and on the imperative.

Verbs as follows: Verbs of the *sentir, pedir* classes, principal irregular verbs; orthographical changes in verbs should be noticed and studied. Careful exercise work. Oral drill.

II.—Dictations, vocabulary work, easy reproductions, oral and written.

Texts for reading: *El Molinerillo y Otros Cuentos* (W. Jenkins & Co.); *Amparo* (R. G. Cortina); *El Final de Norma* (W. Jenkins & Co.); *Victoria y Otros Cuentos* (D. C. Heath & Co.); *Zaragüeta* (Silver, Burdett & Co.), etc.

Third Year.

I.—Grammar:

Finish and review Hills & Ford's.

During this year the Reflexive should be specially studied, also the prepositions *por* and *para.* The use of the *articles* in Spanish should be carefully developed and dwelt upon; the subjunctive should be constantly reviewed in a practical way.

Verbs as follows: Finish the irregular verbs; review verbs showing orthographic changes; thorough review of five classes of

verbs with explanation and reasons for vowel changes; above all, oral and written drill involving actual use of irregular forms.

II.—As much reproduction work as possible.

Texts for reading: *José*—Valdés (D. C. Heath & Co.); *Cuentos Escogidos*—Alarcón (D. C. Heath & Co.); *El Sí de Las Niñas*—Moratín (Ginn & Co.); Knapp's *Spanish Reader* (Ginn & Co.); Matzke's *Spanish Reader* (D. C. Heath & Co.).

Note.—At the discretion of the instructor, Garner's *Spanish Grammar* (American Book Co.) may be substituted for Hills & Ford's, or Ramsey's *Spanish Grammar* (Henry Holt & Co.) may be used.

It is advisable throughout the course to give due importance to the pronunciation and to the oral work. In the earlier stages, the reading may well be made the basis of all work; with children, some progress in reading and in oral work should have been made before the grammar is begun.

After a fair foundation has been laid, special stress should be laid on correctness and accuracy in writing.

It should be borne in mind that the above outline is intended to be mainly suggestive; the individual teacher should adapt it to the needs of his own classes. This is particularly true with reference to the text-books suggested for reading; the list is not exhaustive, and, on the other hand, in no case will all the books mentioned be read; but, from the second year on, from 150 to 250 pages a year might reasonably be expected as a minimum, the actual amount of reading varying with the class, the method pursued, and the collateral work done.

PHYSICAL GEOGRAPHY IN THE HIGH SCHOOL

(One-half unit may be offered.)

The Physical Geography offered to absolve an entrance requirement of the University should include both text-book instruction and laboratory practice. It is thought that five exercises per week for a half year, at least, will be necessary to complete the work. Probably the best results will be obtained by devoting three periods to recitation and the *equivalent* of two periods to laboratory practice. By the equivalent of a recitation period is meant the time actually spent in recitation plus that spent in preparation, that is to say, a laboratory period should be twice if not three times as long as a recitation period. (In the University a laboratory period of three hours is the equivalent of a recitation period of one hour.) While the laboratory work should be under the direct supervision of the instructor, the *pupils* should do the work. All notes should be carefully written and the drawings, maps and diagrams well made. Slovenly work should not be accepted and hasty work should be discouraged.

That there may be a definite understanding concerning the *kind* of laboratory practice required the following sample exercises from *Laboratory Lessons in Physical Geography,* by Everly, Blount and Walton are cited. Equivalent exercises from a *Laboratory Manual in Physical Geography,* by Frank W. Darling, or from *Laboratory and Field Exercises in Physical Geography,* by Gilbert H. Trafton, will, however, be accepted.

I. MATHEMATICAL GEOGRAPHY.

1. A Globe Exercise: To study latitude and longitude, etc., on a globe representing the rotating earth.

2. The Globular Projection of the Western Hemisphere: To represent in a plane the curved surface of half a sphere.

3. Mercator's Map of the Earth: To draw a map that shall represent the surface of nearly the whole earth, and in which the points of the compass do not shift in going across the paper.

4. Sunrise and Sunset Graphs: To sudy and compare graphically the lengths of day and night throughout the year.

5. Standard Time: To study the time belts commonly employed in the United States.

II. MATERIALS OF THE EARTH'S CRUST.

6. Preliminary Study of Minerals: To learn the appearance of minerals in granite.

7. The Study of Minerals: To study in detail the minerals of the preceding exercise together with calcite, gypsum, rock salt, kaolin, etc.

8. The Study of Rocks: (a) Granite and gneiss; (b) limestone and marble; (c) shale and slate; (d) sandstone and quartzite.

9. Coal: To study the characteristics of coal.

10. Hard and Soft Water: To determine whether water is hard or soft.

III. DRAINAGE AND LAND FORMS.

11. First Exercise with Contours: To familiarize pupils with the use and meaning of contours.

12. Second Exercise with Contours: To construct a contour map from numbers placed on a chart.

13. Illinois.—La Salle Sheet U. S. G. S.: To study the earlier stages of river development.

14. Drainage Areas: To map and study the drainage of the United States.

15. Iowa-Illinois.—Savanna Sheet, U. S. G. S.: To study a typical portion of the Mississippi valley and adjacent upland along the middle course of the river.

16. Louisiana.—Donaldson Sheet, U. S. G. S.: To study the swamp flood plain and levees along the lower course of the Mississippi River.

17. Illinois.—Ottawa Sheet, U. S. G. S.: To study a region of immature drainage.

18. West Virginia.—Charleston Sheet, U. S. G. S.: To study a region of mature surface drainage.

19. Kansas.—Caldwell Sheet, U. S. G. S.: To study a region in the central part of the Great Plains.

20. California.—Shasta Special Sheet: To study a young, but inactive volcano.

21. California.—Shasta Special Sheet: To study the glaciers on Mt. Shasta.

IV. THE ATMOSPHERE.

22. Colors in Sunlight: To study the colors that compose white sunlight.

23. Absorption of Colors: To learn how some of the colors of the sunlight may be absorbed by passing through a substance or by being reflected from it.

24. Atmospheric Pressure: To determine whether the atmosphere exerts pressure.

25. Weather Maps: To represent on a map the weather conditions on a given date.

26. Weather Record.

27. Rainfall in the United States: To map and to study the average annual rainfall within the United States.

28. Daily Range of Temperature: To plot and to study the daily changes of temperature in summer and in winter at a place in the interior of a continent and at a place on an island in the sea.

V. THE OCEAN.

29. Section of Ocean Border.—Continental Shelf: To show the widths of the continental shelf, the depths of water, and the slopes of the bottom.

30. New Jersey.—Atlantic City Sheet, U. S. G. S.: To study the sea border of a low growing plain.

31. Maine.—Boothbay Sheet, U. S. G. S.: To study the ocean border of a high rocky plain well dissected by rivers.

32. Winds and Currents: To study the relation of the ocean surface circulation to the planetary winds.

33. Rainfall and Vegetation: To study the distribution of rain over the earth, and the vegetation areas and belts depending on rainfall and temperature.

It is important that the teacher should encourage geographic observations at first hand which may be written up in the form of brief notes or occasional essays. The action of water upon land surfaces can be studied, if only in the temporary rills formed by the falling rains; atmospheric currents—winds—and weather permit of constant observation, and if instrumental, as with vane, thermometer and barometer, so much the better. The study of clouds is a topic of never-failing interest. In the more rugged

portions of our State the decay of rocks may be noted and the physical agents that assist in or promote rock decay studied. On the other hand, the resistance of solid rocks or hard layers to stream wear, with the formation of cascades and waterfalls, affords a fruitful subject for investigation, even if exemplified in the wayside ditch. Then, too, much can be learned by a study of the changes wrought by storms—the effects of wind action and of wave action, especially when of a violent character, as seen in cloudbursts, tornadoes, etc. There is no subject more suggestive to the thoughtful mind than Physical Geography, the problems are so varied and interesting, changing with each locality. Thus wave action may be studied by those living on the coast or near ponds and lakes; cliff disintegration by those living in mountainous regions; the relations of plant life to the underlying rocks by those inhabiting a region of varying geological formations.

To understand physical geography well there must be a complete understanding of maps, especially the contour map. To the pupil such a map should become something more than a mere plan upon paper—it should become a picture with its topographic forms, hills and valleys, lake basins and mountains, plains and plateaus, so brought out as to form a clear and distinct impression. In these days of cheap photographs, correct representations of the relief of most regions can be placed in the hands of the pupil at a trifling cost. In well-equipped schools additional facilities may be afforded by models showing different types of relief and by relief globes. From them various sketches and drawings may be made which will afford practice of substantial value.

Text-books: For recitations one of the following books is recommended: Maury-Simonds' *Physical Geography* (American Book Co.); Davis' *Elementary Physical Geography* (Ginn & Co.); Gilbert and Brigham's *An Introduction to Physical Geography* (D. Appleton & Co.); Tarr's *New Physical Geography* (The Macmillan Co.); Fairbanks' *Practical Physiography* (Allyn & Bacon).

For laboratory practice, exercises, as already indicated, selected from one of the following: *Laboratory Lessons in Physical Geography,* by Everly, Blount, and Walton (American Book Co.); *A Laboratory Manual in Physical Geography,* by Darling, Atkin-

son, Mentzer, and Grover; *Laboratory and Field Exercises in Physical Geography,* by Trafton (Ginn & Co.).

It is felt that students entering the University should possess some knowledge of the State in which they live. It is recommended, therefore, that the geography of Texas be made a part of the school course, as collateral reading, if it can not be given a more prominent position. Text-book: Simonds' *Geography of Texas: Physical and Political* (Ginn & Co.).

Laboratory Equipment.

That portion of the laboratory equipment necessary for the above exercises which should be furnished by the school is as follows:

1 six-inch globe.

1 small ball.

Specimens of granite, calcite, gypsum, rock salt, kaolin, quartz, feldspar, mica, gneiss, limestone, marble, shale, slate, quartzite, lignite, bituminous coal, anthracite.

1 bottle dilute hydrochloric acid.

3 (or more) hand magnifiers.

4 (or more) sets of the map sheets marked U. S. G. S. (United States Geological Survey).

1 glass prism.

1 small mirror.

Most of the above equipment can be supplied by school furnishing houses, with the exception of the maps which must be purchased from the Director of the United States Geological Survey at Washington.

The pupils should furnish their own rulers, dividers, and colored pencils, etc.

PHYSIOLOGY AND HYGIENE IN THE HIGH SCHOOL

(One-half unit may be offered.)

This subject should be so taught in the high schools that it will have a practical bearing directly on the pupils and indirectly on the community. These two objects introduce difficulties in the way of giving general directions. In a malarial district, for instance, the cause of malaria and how to rid the community of mosquitoes would be subjects worth careful consideration. Again, in a community where typhoid fever is prevalent, the subjects of drinking water, the source and contamination of same, and sewage should receive attention. In a community in which much building is done, it would be worth while to consider the questions of sanitary locations, sanitary constructions, the lighting of buildings, the best position for windows, ventilation, etc.

With the above hints concerning the adaptation of suitable questions for study to different communities, we may notice the grade of pupils to be taught. Two courses may be offered, one to pupils in the last years of the elementary school and one to the more advanced pupils of the high school. While the following suggestions are for high-school teachers, they may be of service to teachers of the elementary schools.

To give a successful course in physiology and hygiene, something more is required than just a teacher on the one hand and some pupils on the other. In addition to the teacher and pupils, some laboratory material should be provided.

Laboratory Equipment.

A. Microscope and Accessories.

One or more compound microscopes.

Glass slides and cover glasses (one box of each will be sufficient).

One set of instruments consisting of (a) scissors, (b) forceps, (c) scalpel, (d) two dissecting needles.

One-half dozen pipettes (medicine droppers).

A good section razor.

Glass and rubber tubing.

This material may be secured from Bausch & Lomb, Rochester, N. Y., or from The Spencer Lens Company, Buffalo, N. Y.

B. Models and Skeletons.

Model showing positions of organs in the thoracic and abdominal cavities.

Model of section through head, showing mouth, nose, throat, and position of brain in cranium.

Model of section through skin.

The following may be added when funds will permit: Models of circulatory organs, eye, ear, throat, a mounted human skeleton.

These supplies may be secured from The Kny-Scheerer Company, 225 Fourth Avenue, New York, or from Ward's Natural Science Establishment, Rochester, N. Y.

C. Physiological Apparatus.

A mechanical circulatory apparatus.

A mechanical respiratory apparatus.

An artificial eye. With this the eye structure, near-sightedness and far-sightedness may be demonstrated.

These articles may be secured from the Harvard Apparatus Company, Brookline, Mass.

D. Chemicals.

Hydrochloric acid (diluted to 4 per cent).

Nitric acid.

Strong ammonia.

Alcohol (95 per cent). This should not be denatured, but *ethyl alcohol.*

Ether.

About 200 cubic centimeters of each of the above-named articles will be sufficient.

Chloroform, 500 cc.

Caustic soda or potash, 500 cc.

Castor oil, 500 cc.

Tincture of iodine, small amount.

Glycerine, 200 cc.

Bichromate of potash, 200 cc.

Methyl green stain, 100 cc. (in solution).

Sodium carbonate, 200 cc.

Formalin, 2000 cc.

These chemicals may be secured from Bausch & Lomb, Rochester, N. Y.; or Eimer & Amend, 205-211 Third Avenue, New York. Other chemicals needed but not enumerated here, may be bought from local dealers. Such things as corn starch, flour, potatoes, cane sugar, eggs, vinegar, pancreatic extract, extract of the stomach, rennet, etc., may also be secured from local dealers.

This equipment will probably cost from $100 to $125.

Text-Books.

One of the following text-books may be used: *Overton's Applied Physiology,* Advanced (American Book Co.); *The Human Mechanism,* by Hough and Sedgwick (Ginn & Co.); *Physiology by the Laboratory Method,* by Brinkley (Ainsworth & Co., Chicago); *High School Physiology,* by Hewes (American Book Co.); *A Practical Physiology,* by Blaisdell (Ginn & Co.); *Martin's Human Body* (briefer course), (Henry Holt & Co.); *Coulton's Elementary Physiology and Hygiene* (D. C. Heath & Co.).

Reference Books for Teachers.

Food and Dietetics, by Hutchinson (Wm. Ward & Co.); *Pyle's Personal Hygiene* (Saunders & Co., Philadelphia); *Principles of Sanitary Science and Public Health,* by Sedgwick (Macmillan & Co.).

General Suggestions.

Unless the teacher has had considerable experience, it will be best to use a book containing directions for laboratory work. Hewes, Overton, and Blaisdell indicate laboratory work to be done.

Some dissecting may be done with great advantage. For this rats may be used. These may be chloroformed in a closed can in some other than the school room. The position and shape of the organs of the rat are not unlike those of the human body. The skull of a dog or cat will show teeth best. Circulation may be studied by injecting the system with a solution of red starch.

The antagonistic action of muscles may be shown best by the use of the leg and foot of a chicken.

Any fresh material may be kept in a 6 per cent solution of

formalin. Material preserved in formalin looks as if it were cooked, the nauseating appearance of blood is thus eliminated.

In selecting subject matter for study, teachers are urged to include foods and dietetics and those subjects which deal with every-day life.

Note-Books.

Pupils should be required to record in suitable note-books drawings, statements of experiments performed, references, and comments upon their work. Teachers should examine note-books from time to time, and make such comments and corrections as will tend to add accuracy and interest to the work of the pupils. The note books should represent, in outline, a summary of the work accomplished.

PHYSICS IN THE HIGH SCHOOL

(One or two units may be offered.)

Not merely because of the fact that physics may be offered as fulfilling an entrance requirement of the University of Texas, but because of its marked value as a factor in the education of any and all high-school pupils, it has seemed proper to set forth those methods of instruction which actual experience has shown should everywhere be followed. So, in considering the requirements for "affiliation" in physics or for entrance to the University which are presented in the following pages, it should be borne in mind that the University is not seeking to inculcate any unusual or untried methods of teaching. Rather it is endeavoring to encourage the development of those which, from the standpoint of the interests of the high school and all the pupils taught therein, will lead to the best mental discipline and contribute, so far as lies within the province of any one subject, to that culture which was defined by Mathew Arnold as "knowing one's self and the world."

METHODS OF TEACHING AND DISTRIBUTION OF TIME.

Here the results of actual experience furnish the surest guide. There exists a consensus of opinion among all leading teachers in the high schools, colleges, and universities that the purposes in view can best be subserved by a combination of class-room instruction and individual laboratory practice, occupying at least five school periods of forty-five minutes each, per week, throughout the year.

There is an equal agreement with the opinion that, of the five periods a week devoted to the course, three periods should be given to class-room instruction and two to laboratory exercises. Since the student need make no special preparation for these exercises, beyond reading over carefully the directions to be followed, it is strongly recommended that the time devoted to them be increased to two consecutive periods on two days of the week, thus giving four periods to laboratory work. This can be easily accomplished by such an arrangement of the schedule as will give a study period preceding the recitation period, the same to be added to the laboratory period on the days when laboratory instruction is given. So

much time is required for the adjustment of the apparatus and the recording of notes and observations on the experiments that it is difficult to accomplish any work of real value in a single period. Moreover, it is found that, far from proving a strain upon the student, the use of the two periods in laboratory practice creates a greater interest in the work and prevents it from degenerating into a sort of kindergarten exercise.

CLASS-ROOM INSTRUCTION.

The Text-Book.

With no wish to discriminate in favor of particular text-books as against others that experience proves to be of equal merit, the following list is submitted, in alphabetic order, as fulfilling the requirements for thorough instruction: Andrews and Howland's *Elements of Physics* (The Macmillan Co.); Carhart & Chute's *High School Physics* (Allyn & Bacon); Cheston, Gibson & Timmerman's *Physics* (D. C. Heath & Co.); Crew's *Elements of Physics* (The Macmillan Co.); Goodspeed's *Gage's Principles of Physics* (Ginn & Co.); Hoadley's *Brief Course in Physics* (American Book Co.); Mann and Twiss' *Physics* (Scott, Foresman & Co.); Millican and Gale's *First Course in Physics* (Ginn & Co.).

Recitations and Lectures.

In the class-room, the advantages of both lectures and recitations should be combined, frequent illustrations being necessary in order to impart correct ideas. For this purpose, simple apparatus, largely home-made, is desirable as best calculated to stimulate the interest which leads to independent thought and study. Highly finished and expensive apparatus is not only unessential, but it often distracts the student's attention from the purposes of the illustration and leads them to conclude that polished brass and mohogany are requisites to successful experimenting. Properly arranged experiments will illustrate the principles involved and also teach the scholar, in the study of physical phenomena, to secure compliance with the essential factors regardless of external appearances. Fortunately, such necessary apparatus as can not be easily constructed by the teacher and scholars can be purchased at very reasonable prices from several makers, the equipment of high schools having

created a demand for apparatus which, while simple, is accurate and satisfactory.

Numerical Problems.

Special emphasis should be placed upon the solution of numerical problems without which the training is sure to prove superficial and inaccurate. It is desirable to assign at least four problems at each recitation, the solutions to be handed in at the next exercise, to be corrected and returned later. One of the problems should refer to some portion of the text studied at an earlier date, constant review work being essential. Much time will be saved in the correction of these exercises if the scholars be compelled to present the solutions neatly done on paper of uniform size. The corrected problems, if preserved, will prove of distinct advantage to the student in any further work in the subject.

To supplement the problems given in the text-book the teacher will find it of assistance to use one of the various books of problems, such as, for example, Pierce's *Problems of Elementary Physics* (Henry Holt & Co.); Snyder and Palmer's *Problems in Physics* (Ginn & Co.).

Training in English.

In every case, whether it be in the oral recitation or in the written work, the student should be required to use good English and to express himself clearly and accurately. It is a common and well-founded criticism that scientific or technical students are lamentably weak in the handling of their mother tongue. While it is true that the student of the classics or the modern languages has a distinct advantage in this respect through his constant study of linguistics and exercises in translation, and that we may reasonably expect of him a higher standard of literary expression, there is, on the other hand, no excuse for the use of bad grammar and poorly constructed sentences on the part of the student of science. Certainly any disparity in the degree of training in English afforded by the subject itself should be compensated for, as far as possible, by the placing of emphasis on this part of the instruction.

LABORATORY PRACTICE.

Its Character.

Since a proper understanding of the subject can not be acquired without individual laboratory practice, especial attention should be given to the development of this portion of the course. *In fact, laboratory work is a sine qua non. No amount of careful class-room work can compensate for the lack of it and where prevailing conditions will not allow of its introduction the entire subject had best be cut out of the curriculum.*

It is not sufficient for the teacher to perform the experiment before the class and the student to copy the data furnished him and to deduce or verify the principle involved. The real value of laboratory work is only secured when the student performs the experiment himself, obtaining and classifying all data and with the least possible assistance. It may, indeed, be necessary, during the first few weeks or months of the course, for the teacher to first perform the experiment rapidly before the class, calling attention to its object, the reasons for the method used and any difficulties to be encountered, but as rapidly as possible, the student should be encouraged to work independently.

He should also be made to study the method and laboratory directions in advance and during the laboratory period to rely upon the text as little as possible. Unless care is taken, the scholars soon fall into the habit of blindly following the manual and recording results, without making the effort necessary for the understanding of the sequence of the phenomena or the aim of the observations. Constant oversight and questioning of the individual is the only safeguard and is well worth the effort.

The Exercises.

Laboratory exercises should be chosen with particular care, since upon their character largely depends the success or failure of the course. In general, each exercise should possess certain characteristics. "First, it should compel close observation and discrimination and develop in the experimenter some skill and self-reliance. Second, it ought to contain the basis for the development of a generalization or it should verify a principle already deduced. Third, the reasoning involved in reaching the conclusion must be simple

and direct enough to be made by the student himself with very little assistance. Fourth, and most important, it must be distinctly quantitative in character and susceptible of a reasonable degree of accuracy." There is no reason for giving simple qualitative experiments which "merely illustrate, if they illustrate anything, principles with which the twelve-year-old boy has for some time been more or less familiar. It is undesirable to insult the intelligence of the boy even though he may not be able to return the compliment. The following is an example of the type referred to:

Experiment: Carefully examine your pencil; drop it on the floor; pick it up. Has it suffered any change?"

This example may seem to be an isolated and exaggerated one, and yet an examination of the note-books submitted to the University during the past two years shows the presence therein of some, at least, of this kind of trash—trash because it is wholly without educational value. Good qualitative experiments have a place, but it is in the class-room and not the laboratory.

Fortunately, there are at present several well-known manuals, the exercises in which are thoroughly practical, of definite value, and have stood the test of years of trial. While it is always well for the teacher to develop the ideas which come to him through experience in the laboratory, it is certainly wise for the beginner to confine himself to these experiments which are known to be sound in theory and practice.

Among such manuals may be mentioned the following: Allen's *Laboratory Physics* (Henry Holt & Co.), Cheston, Dean and Timmerman's *Laboratory Manual of Physics* (American Book Co.); Chute's *Physical Laboratory Manual* (D. C. Heath & Co.); Crew & Tatnall's *Laboratory Manual of Physics* (The Macmillan Co.); Millican & Gale's *Laboratory Course in Physics* (Ginn & Co.); Nichols, Smith and Turton's *Manual of Experimental Physics* (Ginn & Co.); Turner and Hersey's *National Physics Note-Book* (L. E. Knott Apparatus Co.).

In Exhibit "A," appended to this article, will be found a list of ninety experiments of standard excellence, from which selection should be made according to the nature of the course. The thirty-five of these which are marked with an asterisk are specially recommended as a basis for a one-year course.

The Note-Book.

Special attention should be given to the note-book, since it also is an important factor and of marked educational value to the student. "It compels him to put in writing the thoughts that are in his mind; it aids him to a clearer expression of thought; it trains him with increasing thoroughness in composition; it impresses more firmly upon his mind the facts he has learned in the development of the experiment; it enables him to acquire more systematic methods of doing things, and, as the note-book should never, save on rare occasions, be taken from the laboratory, it teaches him to do things now and not to wait until tomorrow or some other convenient time." "To these ends it must be insisted that the notes should be neatly written, clear, concise, and simple, containing only that which is necessary to make them complete and, finally, as nearly correct as the manual skill and mental caliber of the student will permit."

More specifically, the note-book should contain a concise statement of:

(a) The problem to be solved with reference to page of manual used.

(b) Apparatus used.

(c) Necessary formulas and computations.

(d) Observed results, together with such inferences as the pupil may be reasonably expected to draw.

Apparatus.

While, from the point of view of individual work, the ideal method is to provide for each experiment sufficient apparatus to supply the entire class working separately, considerations of expense preclude it in the majority of cases. Moreover, practically as good results can be gotten if the students work in pairs and two experiments are alternated. Vigilance, however, must be exercised to prevent the lazy student from depending upon a more efficient partner and thus failing to derive any benefit from the exercise.

In Exhibit "B" is given a list of apparatus necessary to conduct a class of twelve students through the thirty-five experiments before mentioned. This list can be purchased complete from any

one of several concerns that make a specialty of school apparatus, at a cost of less than $100.

Since, however, the experience of the "affiliated high schools" has show that at least forty-five exercises can easily be completed, the list of apparatus purchased should not be limited to this amount, but should be as extensive as possible. This estimate is given merely to show that it is possible at small expense to make a good beginning in the direction of thorough instruction.

It is understood that in the foregoing estimate no provision has been made for apparatus for lecture demonstration which, of course, should be provided as rapidly and in as large amount as possible. The outlay necessary for this purpose will depend much upon the ingenuity of the teacher and his ability to make use of home-made apparatus which, as before noted, is often far more valuable than any that can be purchased.

Then, too, the estimate does not include the expense of fitting the laboratory with desks, tables, cases, shelves, etc., the cost of which will depend much upon the size of the rooms assigned for the purpose and to local conditions.

In general, the tendency is to underestimate the cost of good instruction in physics and experience shows that laboratory practice for a class of twelve students should not be introduced unless an appropriation of at least $250 can be made for apparatus and other equipment. For larger classes a proportionately greater sum will be required.

Among the concerns supplying school apparatus may be mentioned the following: L. E. Knott Apparatus Co., No. 15 Harcourt St., Boston, Mass.; C. H. Stoelting Co., 31 W. Randolph St., Chicago, Ill.; Central Scientific Co., 14 Michigan St., Chicago, Ill.

In any case, it is suggested that the school intending to purchase apparatus should submit a list of the articles desired to several firms and request bids on the same with freight paid to destination.

The Laboratory.

As in the college or university, in every case, when feasible, a separate room, and that as large as possible, should be set aside as a laboratory. Such a room will not only be convenient and well adapted to teaching purposes, but will prove a source of pride to

the students and to the community and encourage a continual advancement in the direction of high-grade instruction in all the natural sciences.

DEVELOPMENT OF THE COURSE.

While, as has been stated, it is possible to begin the teaching of physics with but a small expenditure, it should be clearly recognized that it is merely a beginning and that continual progress is necessary. It was a wise man who said that "To be as good as our fathers we must be better. Imitation is not discipleship." The education of yesterday must not be that of today, or of today that of tomorrow. True of all subjects of value, it is especially true of natural science instruction, in which we must continually take cognizance of new ideas and discoveries. Progress in the teaching of physics demands a steady increase in the facilities for instruction and the early adoption of a plan for the development of the course, to be consistently followed year after year.

Too much emphasis, therefore, can not be placed upon the necessity for yearly appropriations for the purchase of apparatus and equipment, since only in this way can the instruction be brought to the proper standard and there maintained. These appropriations need not be large, but they should be as much a recognized part of the annual budget as the teacher's salary. This procedure will not only build up a course of instruction of increasing strength and value, but it will stimulate both teacher and pupil with fresh interest in the subject and prove in the end the most economical of money, time, and energy.

THE TEACHER.

Such a course as that outlined in the foregoing pages requires ceaseless effort on the part of the teacher and the continual use of every faculty. To properly conduct recitations and illustrate them by means of carefully chosen experiments, to examine and grade numerous examination and problem papers, to conduct laboratory classes and prepare the experiments for the same, to care for the apparatus and construct new pieces, all this is not an easy task.

In a report of a committee appointed by the National Educational Association, the following statement is made: "To give good instruction in the sciences requires of the teacher more work than

to give good instruction in mathematics or the languages, and the sooner this fact is recognized by those who have the management of schools, the better for all concerned. The science teacher must regularly spend much time in collecting material, preparing experiments, and keeping collections in order, and this indispensable labor should be allowed for in programs and salaries."

One fact remains to be emphasized, namely, that, save in rare instances, it is not practicable for one to attempt to conduct a course thus outlined when the only instruction that the teacher has received is of the grade required for a permanent State teacher's certificate. This may appear to be a plea for the employment of University graduates, but in reality it is not the case. The fact remains that the developments of physical science and the methods of teaching it have been and continue to be so rapid, involving so much detailed knowledge and experience, that it is not practicable or desirable to demand of every teacher specific training in these directions. It is, however, perfectly feasible for any teacher of ability, who has previously studied elementary physics, to secure the additional training necessary through Summer School courses in the University of Texas, Chicago, and other institutions of equal rank, and it is, I believe, the duty of every school board to insist that the teacher of physics shall have received this amount of preparation for his chosen work.

AFFILIATION WITH THE UNIVERSITY.

During the past few years a number of high schools have been affiliated with the University in Physics and many more are arranging their courses with this in view. For the consideration, therefore, of these schools a brief statement may be made of the conditions which should be met.

In order to secure affiliation it is necessary for the high school to conduct a course of the character outlined in the foregoing. More specifically, the requirements are as follows:

I. For One Unit Entrance Credit.

1. Five school periods, of at least forty minutes each, a week, throughout the school year, shall be devoted to the subject. At least two periods shall be given to laboratory practice and three to class-room exercises.

2. A high-grade text-book shall be used.

3. Numerical problems shall be assigned for solution outside the class-room.

4. Individual laboratory practice shall be given, and there shall be sufficient apparatus to allow of the students working in pairs.

At least thirty-five laboratory exercises, taken from the list given in Exhibit "A," shall be completed during the year.

The students shall take careful notes on the experiments in a suitable note-book.

Should they desire to enter the University and secure credit in physics, they must present these note-books when the application for credit is made and especial weight will be given to them in estimating the character of the work done by the school.

II. For Two Units Entrance Credit.

In view of the desire expressed by certain high schools to extend their courses in physics over two years, and to receive two units of entrance credit, it has seemed best to state in general the conditions under which such credit will be given. For successful work in such a course so much depends upon the individual teacher and the facilities at his disposal that it is not deemed wise to formulate a definite plan for all such schools. Therefore, for the present, at least, each request for affiliation will be considered by itself, and the double credit allowed only when a full examination shows that the work done reaches the higher standard required for such a course. In general, it is recommended that schools should not attempt a two-year course unless the class-room and laboratory equipment is of the best and the teacher employed capable of giving the more advanced instruction required. Only in very rare cases should the course be attempted *de novo,* but it should be based on an already existing one-year course, the conditions for affiliation on the one-unit basis having already been met in the fullest manner.

In general, the requirements will be as follows:

1. Five school periods, of at least forty minutes each, a week, throughout two years, shall be devoted to the subject.

The two years shall be the last two years of the high-school course.

At least two periods a week shall be given to laboratory practice and three to class-room exercises.

2. One of the simpler of the texts recommended shall be used the first year, and one of the more advanced or extended texts the second year, or the more advanced text shall be used throughout the course, the subject being so divided as to cover separate topics each year, but allow for a general review during the spring term of the last year.

3. Special attention shall be given to the solution of numerical problems.

4. Individual laboratory practice shall continue throughout the two years, and there shall be sufficient apparatus to allow of the students working in pairs.

At least seventy laboratory exercises taken from the list given in Exhibit "A" shall be completed during the two years.

5. Special attention shall be given to the making of notes on the experiments performed and students who desire to enter the University and secure credit in physics must present their note-books when the application for credit is made.

EXHIBIT A.

List of Experiments for Laboratory Practice.—Mechanics and Properties of Matter.

1. A comparison of the metric and the English units of length.

*2. Determination of the volume of a regular body, by measuring its linear dimensions with a millimeter scale.

*3. Determination of the volume of an irregular body, by measuring or weighing the amount of water displaced by it.

4. Experimental determination of π (the ratio of the circumference to the diameter of a circle), by measuring the circumference and diameter of an accurately turned disc.

*5. Determination of the mass per unit volume (density) of a substance, by weighing it and measuring its volume.

6. Principle of the vernier, and use of the vernier caliper.

7. Principle of the screw micrometer, and use of the micrometer caliper.

8. Verification of the laws of pressure of liquids, by measuring the pressure at various distances below the surface of water contained in a deep vessel.

*9. Lifting effect of a liquid on a body totally immersed in it (Archimedes' Principle), by weighing a body of known volume in water and in air.

*10. Determination of the specific gravity of a solid heavier than water, by finding the volume of the solid from its loss in weight when suspended in water.

11. Determination of the specific gravity of a solid lighter than water, by using a sinker to immerse the body completely in water.

*12. Determination of the specific gravity of a liquid, by using a specific gravity bottle.

13. Determination of the specific gravity of a liquid, by measuring its buoyant action on a body of known volume suspended in it.

*14. Determination of the specific gravity of a liquid, by balancing columns (Hare's method).

15. Determination of the pressure of a gas, by measuring the heights of the liquid columns in several manometers containing liquids of different densities.

*16. Verification of Boyle's law for air.

17. Measurement of the pressure of the atmosphere (Torricelli's experiment).

18. Verification of the laws of uniformly accelerated motion, by measuring time and distance passed over in the case of a ball rolling down a smooth inclined plane.

*19. Verification of the laws of equilibrium of parallel forces.

*20. Verification of the law of the parallelogram of forces.

21. Determination of the coefficient of friction between two surfaces.

22. Verification of the laws of the lever; the law of moments.

23. Verification of the law of action and reaction.

24. Determination of the center of gravity of a flat body of irregular shape, by suspending it from different points in succession.

*25. Verification of the law of the inclined plane.

*26. Determination of the mechanical advantage of the pulley.

*27. Verification of the laws of the pendulum.

28. Verification of Hooke's law of elasticity, by measuring the extension of a spring under varying loads.

29. Verification of the laws of bending of rods, by measuring

the amount of bending, under various loads, of rods of varying dimensions but of the same material.

30. Verification of the laws of torsion of rods, by measuring the angle of torsion due to varying moments of force applied to rods of different lengths and thickness.

Sound.

31. Determination of the number of vibrations per second of a tuning fork.

*32. Measurement of the speed of sound in air, by observing the time required for a sound to traverse a measured distance.

*33. Determination of the wave length of a musical sound, by measuring the length of tube which will give resonance with a tuning fork of known frequency.

*34. Verification of the laws of vibration of stretched strings.

35. Determination of the speed of sound waves in a rod, by Kundt's method.

Heat.

*36. Determination of the fixed points (0° and 100°) of a mercury thermometer.

*37. Determination of the coefficient of linear expansion of a rod.

*38. Determination of the temperature of maximum density of water.

39. Measurement of the expansion of air at constant pressure, by observing the change in length of a column of dry air confined in a capillary tube by means of a drop of mercury.

40. Determination of the coefficient of expansion of air at constant volume, by measuring, by means of an adjustable manometer, the change in pressure of dry air enclosed in a bulb subjected to different temperatures (ice and steam), the volume being kept constant by adjusting the manometer.

*41. Determination of melting points of solids, *e. g.*, paraffine, acetamide.

42. Determination of the boiling points of liquids, *e. g.*, salt solutions of varying concentrations.

*43. Determination of the dew point, by observing the temperature at which atmospheric moisture begins to condense on (evapo-

rate from) the polished surface of a vessel containing a liquid which is being slowly cooled (warmed).

44. A study of the laws of cooling, by observing the rate of cooling of identical vessels containing equal quantities of hot water, one vessel having a blackened and one a polished surface.

*45. A test of the "method of mixtures," by observing the temperature of the mixture when varying quantities of water at different temperatures are poured into a calorimeter, whose initial temperature should be as near as possible that of the mixture.

46. Determination of the "water equivalent" (heat capacity) of a calorimeter and thermometer, by observing the amount of heat used up in warming up the calorimeter and thermometer when warm water is poured into the calorimeter containing a small quantity of water and the thermometer.

*47. Determination of the specific heat of a solid, by the method of mixtures.

*48. Determination of the latent heat of ice, by the "method of mixtures."

49. Determination of the latent heat of steam, by the "method of mixtures."

50. Observation of the rate of cooling of a substance as it passes through a change of state, liquid to solid, *e. g.*, a test tube with acetamide cooling, without being stirred, from about 95° C. to 45° or 50° C.

51. Study of the relation between the temperature and pressure of steam from boiling water, by observing the temperature of the steam in a closed boiler, the pressure being regulated by partly confining the steam, and measured by means of an attached mercury manometer.

Light.

*52. Study of the law of intensity of illumination, simple photometer.

*53. Verification of the laws of reflection from a plane mirror.

*54. Study of the formation of images by a single plane mirror, and by two plane mirrors placed at varying angles with one another.

55. Study of the images formed by a convex cylindrical mirror.

56. Study of the images formed by a concave cylindrical mirror.

57. Determination of the conjugate foci of a concave spherical mirror.

*58. Determination of the index of refraction of plate glass, by tracing the direction of a beam of light in glass and in air.

59. Measurement of the index of refraction of water.

60. Study of the deviation of a beam of light by a glass prism, and measurement of the index of refraction of the prism.

61. Study of the images formed by a convex lens.

62. Study of the images formed by a concave lens.

63. Determination of the principal focus of a convex lens.

64. Determination of the conjugate foci of a convex lens.

65. Determination of the magnifying power of a single lens.

66. Construction of a simple telescope and determination of its magnifying power.

67. Construction of a compound microscope and determination of its magnifying power.

Electricity and Magnetism.

68. A study of magnetic phenomena.

69. A study of electrostatic phenomena.

70. Plotting the lines of force around a bar magnet, by using iron filings or by a small compass.

71. Plotting the lines of force around a conductor carrying a current.

72. Study of a single-fluid cell.

73. Study of a two-fluid cell.

74. Study of the effect of grouping batteries in series or in parallel.

75. Measurement of resistance by substitution.

76. Verification of Ohm's law.

77. Measurement of the drop of potential along a wire carrying a current.

78. Measurement of resistance by voltmeter and ammeter.

79. Measurement of electric resistance by means of the Wheatstone bridge.

80. Study of the effect of temperature on the resistance of a wire.

81. Measurement of resistance of conductors joined in series and in parallel.

82. Study of electrolysis and the storage battery.

83. Study of the action of a current on a magnet, simple galvanometer.

84. Study of the principle of the D'Arsonval galvanometer.

85. Study of the electric solenoid and electromagnet.

86. Study of the electric bell.

87. Study of the electric telegraph.

88. Study of the electric motor.

89. Study of the laws of induced currents.

90. Study of the electric dynamo.

EXHIBIT B.

Laboratory Apparatus for Physics.

Estimate of laboratory apparatus required by a class of twelve students for performing the thirty-five experiments marked by an asterisk in Exhibit "A," one-third of the class working at the same problem, and the students working in pairs.

Exp. No.	General apparatus and supplies.	Quantity.	Price each.
	Wood meter rods—brass ferrules	6	$ 0.30
	30 cm. wooden scales	3	.10
	15 or 30 cm. steel metric scale	2	1.00
	Paper m. m. scales	1 doz.	.15
	Rubber tubing, medium weight, ¼ inch	½ lb.	.80
	Rubber tubing, medium weight, 3-16 inch	½ lb.	.80
	Rubber tubing, pressure, ⅛ inch	¼ lb.	.80
	Glass tubing, 1½ inch	1 lb.	.60
	Glass tubing, 3-8 inch	1 lb.	.45
	Glass tubing, ¼ inch	1 lb.	.45
	Glass tubing, capillary, assorted	1 lb.	.75
	Insulated copper wire, No. 16	1 lb.	.60
	Insulated copper wire, No. 20	1 lb.	.75
	Spring brass wire, No. 24 or 26	spool	.30
1	Wooden cylinders, about 4x6 cm	4	.25
2	Overflow cans	2	.45
	Catch buckets, for catching water displaced	2	.20
3	Balances, trip scales, or better	2	6 to 10.00
	Weights, 1 g. to 500 g	2	1.80
8	Bottles, wide mouth, glass stopper	2	.10
12	Apparatus made of one piece small size glass tubing closed at one end, and a larger size tubing open at both ends, each about 12 in. long, connected by about 30 in. rubber pressure tubing, forming a flexible U-shaped tube. A meter rod for measuring height of mercury in the tubes.		
	Mercury	2 lb.	.80
15	Spring balances, about 2000 g. capac	6	.50
	Cord, fish line		.25
16	Meter rods, spring balances (see above).		
	Iron weights, up to 2000g	1 set	1.75
19	Straight, smooth boards for inclined plane (made by carpenter)	2	.15
	Spring balances, about 250 g. capacity	2	.60

Exp. No.	General apparatus and supplies.	Quantity.	Price each.
20	Brass single pulleys	2	.30
21	Brass double pulleys	2	.40
	Metal balls, about ½ in. diam.	2-6	.05
22	Silk thread, A, one spool		.10
24	Spy glass		2.50
	Tuning fork, middle C	1	1.25
	Tuning forks, small, A	2	
	Large size glass tube, open, 10-15 in. long	2	
25	Hydrometer jar, to hold water for regulating length of air column in above glass tube	2	.50
26	Brass wire, spring balances, tuning forks (see above).		
	Thermometers, centigrade scale	4	.90
	Copper boilers ("Apparatus A.")	2	1.00
27	Gasoline blast lamps, for laboratories not furnished with gas.	2	2.25
28	Linear expansion apparatus	2	2.50
	Small wide mouth bottles	2	.05
	Rubber stoppers, two holes, to admit thermometer and small bore glass tubing	2	.05
30	Glass tubes, about 1 mm. bore, 8-10 in. long	2	
	Glass beakers, about 8 oz.	4	.25
32	Paraffine	1 lb.	.40
34	Small size nickled cans (see catch buckets above)	2	
	Calorimeters, large size for outside	2	.45
35	Calorimeters, small size for inside	2	.45
36	Copper shot, lead shot, or pieces of brass or copper wire	1 lb.	.30
38	Calorimeters, same as above		
	Candles (tallow or paraffine)		.25
	Screen of white paper, or ground glass. Lead pencil set in a cork to cast the shadow, meter rod		
39	Plane mirrows, plate glass	4	.15
40	Pins, one paper		.10
	Smooth soft pine boards for drawing board (made by carpenter)	4	.10
43	Plate glass slab, polished edges	4	.25
46	Convex lenses	4	.10
47	Lens holders to fasten to meter rod	4	.20
	Screen and pin holders	4	.30
50	Bar magnets	4	.30
	Iron filings	1 lb.	.15
	Compasses, very short needle	4	.25
54	Tumblers, for use as battery jars	2	.20
	Zinc and copper strips	2 pr.	.10
	Sulphuric acid	½ gal.	.75
	Daniell cells, large size	2	2.00
	or American primary battery	2	2.50
	Dry batteries, for open circuit work	4	.35
	Resistance boxes	2	8.00
	Astatic or d'Arsonval galvanometers	2	3 to 7.00

EXHIBIT C.

Books for Reference.

That every school should possess a library for the use of both teachers and pupils is a proposition that does not require demonstration. That in forming such a library the interests of students of science should not be neglected, will also be admitted. To that end the following brief list is submitted in the hope that it will prove suggestive and lead to increased interest on the part of both pupils and teachers:

A Text-Book of Physics, by William Watson (Longmans, Green & Co.).

Units and Physical Constants, by J. D. Everett (The Macmillan Co.).

Experimental Science, by George M. Hopkins (Munn & Co.).

Elementary Practical Physics, by Stewart and Gee (The Macmillan Co.).

Soap Bubbles, by C. V. Boys (Society for the Promotion of Christian Knowledge).

Spinning Tops, by John Perry (Society for the Promotion of Christian Knowledge).

Light, Visible and Invisible, by S. P. Thompson (The Macmillan Co.).

Elementary Electricity and Magnetism, by S. P. Thompson (The Macmillan Co.).

Also, it will be found helpful to the teacher to have at hand copies of the various text-books and laboratory manuals previously named, as each will offer valuable suggestions and illustrations for both the class-room and laboratory.

In addition, it is advisable for the teacher and students to have access to one or more of the more popular scientific journals for it will constantly stimulate their interest and cultivate at the same time the habit of reading and of connecting the principles studied with their applications in everyday life.

One plan that has been successfully tried is to form a club, the members of which contribute a small sum toward the subscription price of the journals, the remainder being paid by the school. At the close of the year the journals are bound and added to the school library. When the city or town supports a circulating library with reading room, any such arrangement is, of course, unnecessary.

Among the many journals the following are suggested as most likely to prove of value:

School Science and Mathematics.

Nature, The Macmillan Co.

Scientific American, Munn & Co.

Scientific American Supplement, Munn & Co.

CHEMISTRY IN THE HIGH SCHOOL

(One or two units may be offered.)

The introduction of chemistry as one of the optional requirements for admission makes it necessary to publish specific information concerning the character of work that must be done by candidates for admission who present this subject. Chemistry properly taught has as much educational value as any other subject; badly taught, it is valueless, and, to avoid any misunderstanding on the part of candidates for entrance, and also in order to give the secondary schools due notice of what will be expected of them, the "Special Report of the Committee on Chemistry Presented to the Committee on College Entrance Requirements of the National Educational Association" (majority report) is published here in full. The University of Texas desires to see this report in force at once, because it means that chemistry will be rationally taught,—that dogmatism and text-book idolatry, in so far as chemistry is concerned, will be buried.

A note-book containing a complete record of the experiments he has performed, and certified by the teacher, must be presented at entrance by the candidate. The note-book must bear evidence that the candidate has formed the habit of keeping an intelligible record of laboratory work extending through the entire series of experiments performed.

The Special Report of the Committee on Chemistry, presented to the Committee on College Entrance Requirements of the National Educational Association, is so valuable that it is reprinted here in its entirety.

"SPECIAL REPORT OF THE COMMITTEE ON CHEMISTRY.

"PRESENTED TO THE COMMITTEE ON COLLEGE ENTRANCE REQUIREMENTS OF THE NATIONAL EDUCATIONAL ASSOCIATION IN 1899.

"I. Value and Place of Chemistry.

"The study of chemistry is a valuable constituent of the high-school course on account (1) of the training in observation in general and correct induction from observation which it affords, and

(2) of the first-hand information which it gives about well-known materials, the principles of their manufacture, and their properties, as the result of personal observation.

"The college invites its study in preparatory schools on account of these two benefits. To be of subsequent use the method and content of the courses in preparatory schools must be definite and uniform. The selected matter must be thoroughly taught, so as to form a recognizable constituent of the preparation of those who present it. When these conditions are fulfilled, the college must give proper recognition to the work. All colleges must give admission credit for the subject. In addition to this each college must provide definite means for advancing the entrant in chemistry to an extent corresponding to his previous knowledge of the subject. The precise method of doing this will depend upon the nature of the course the college itself offers. In any case no pupil who offers chemistry for entrance, and receives definite credit for it, should be placed in the same class with beginners who had no such credit.

"Without laboratory work school chemistry is wholly valueless for the purposes just mentioned. It should be preceded by physics, since chemistry necessarily assumes a knowledge of the physical properties of matter and of the phenomena connected with heat and electricity. If, on account of limited teaching force, relatively little time can be given to the science, it is preferable to give a year each to one or two sciences than shorter periods to a larger number. It must be remembered that, for the efficient teaching of science, preparation of apparatus and experiments for demonstrations and laboratory work are necessary, and the science teacher can not, therefore, carry more than half the number of recitations assigned to most other teachers.

"OUTLINE OF A ONE-YEAR COURSE.

"The work outlined below will demand at least 200 hours' work; about half the time, in two-hour periods, should be spent in the laboratory.

"II. Method of Teaching.

"*Laboratory Work.*—The experiments must be performed by each pupil individually.

"Each pupil must record his observations and the interpretation

of them in a note-book. His work should be continuously supervised and his records frequently examined by the teacher.

"Most pupils will tend to fall into merely mechanical performance of assigned work. To combat this is the most difficult task of the teacher of chemistry. Each experiment is a question put to nature, and forethought and care are necessary in putting the question, and study and reflection in interpreting the answer. Strenuous effort is required to make the pupil realize this. The questions incorporated in the laboratory outline, to which answers are expected as part of the notes; individual questioning in the laboratory; above all, frequent, thorough quizzing of the whole class, are the best means of forcing the significance of this practical work into the foreground.

"Beginning at an early stage in the course, simple quantitative experiments should be given, in order to illustrate the laws of definite and multiple proportion, the determination of combining and equivalent weights, the specific gravity of gases, etc. This will enable the pupil to appreciate the fact that, although the quantities used in the majority of laboratory exercises may not be measured, yet the proportions and the compositions by weight of substances involved in all chemical changes are definite and measureable. Without such measurements atomic weights will seem purely mythical. Not less than six such exercises should be given. One or two of these experiments must be introduced early, in order that formulæ and equations, when the time for their employment comes, may be given as abbreviated expressions of the results of quantitative measurements.

"Qualitative analysis is a branch of applied chemistry, and can not be learned otherwise than mechanically without a long preparation in general chemistry. There should be no pretense of teaching it in a secondary school as part (much less as the whole) of the first year's work. It gives a distorted view of the classifications of the elements and of the relative importance of their properties, and bears the same relation to the science of chemistry that the Linnæan system of classification in botany bears to the natural.

"Yet exercises on the recognition of chemical substances will tend to fix their properties in the mind and give a useful review of many of the facts and principles of the science, provided that a proper method of conducting them be pursued. Analytical tables encour-

age mechanical work in a remarkable degree, and can not be permitted. An outline suggesting suitable dry and wet-way experiments, which will throw the burden of thought and rigid proof on the pupil, will be a sufficient guide. This part of the work may fitly occupy five or six weeks of the course.

"*Class-Room.*—Many parts of the subject can best be introduced by means of carefully reasoned and fully illustrated demonstrations by the teacher. Sometimes also this method of teaching has to be used where the apparatus is complicated and can not be supplied to each pupil, or where, in striving to make the experiment successful, the pupil will be in danger of wasting time. Thus on pedagogical or practical grounds some of the Hofmann experiments for illustrating the application of Avogadro's hypothesis (explosion of hydrogen and oxygen, electrolysis of hydrochloric acid, etc.) are best performed by the teacher. (No teacher should fail to read Hofmann's admirable *Lectures on Modern Chemistry,* 1865.) The line of thought to be developed in connection with the experiments performed by the teacher and by the pupil is well given (pp. 1-9) in the Harvard *Requirements in Chemistry,* by Professor Richards.

"The theories and principles must be presented inductively. They should not be stated as dogmas, or as if they were part of the facts. They should be held in reserve until some accumulated facts demand explanation and correlation. Facts incapable of correlation should be avoided as far as possible. On the other hand, explanations by the handy affinity idea are worse than useless, as they are generally pure nonsense. When symbols and formulæ are first introduced, special care must be taken to show how they are derived from quantitative measurements. The pupil's own observations and other examples must be used to show how the formulæ and finally the equations, are reached as expressions of quantitative relations. The whole process of determining the proportions by weight and constructing the formulæ and equations must be done or described in connection with every chemical change, until the pupil is thoroughly familiar with the operation and the exact significance of the equation is perfectly clear (cf. Harvard pamphlet already mentioned, p. 24, on this point). Formulæ must on no account be used before this can be done, as otherwise they will inevitably appear to be the source of information instead of the receptacle for it All "exercises in writing equations" and rules for constructing

them, as if they were mathematical expressions, must be rigidly excluded as fantastic and misleading. The misuse to which equations have been put has led to their omission or prolonged postponement by some teachers. Their introduction at an early stage can do no possible harm, provided the laboratory work contains exercises specifically intended to illustrate the way in which the facts recorded in the equations are ascertained and the manner in which the equations are constructed from these facts. The atomic theory should not be introduced until after this experimental foundation of the equation is thoroughly familiar. The equation has no necessary connection with this theory. The teacher will derive valuable hints in regard to method from Perkin and Lean's *Introduction to Chemistry.*

"*Library.*—Interest in the study should be fostered by providing a small library. The use of this will counteract the idea which the pupil may possibly receive that the text-book employed in the class is a 'complete' treatise. It should contain some more advanced works, as well as some of a more popular nature.

"*III. Subject-Matter.*

"The following outline includes only the indispensable things which must be studied in the class-room and laboratory. The material is, for the most part, common to all elementary text-books and laboratory manuals. Each book makes its own selection of facts beyond this which may be necessary for the illustration of the principles of the science. The order of presentation will naturally be determined by each teacher for himself.

"*Outline.*—The chief physical and chemical characteristics, the preparation and the recognition of the following elements and their chief compounds: *Oxygen, hydrogen, carbon, nitrogen, chlorine, bromine, iodine,* fluorine, *sulphur,* phosphorus, silicon, potassium, *sodium,* calcium, magnesium, *zinc,* copper, mercury, silver, aluminium, *lead,* tin, *iron,* manganese, chromium.

"More detailed study should be confined to the italicized *elements* (as such) and to a restricted list of compounds, such as water, hydrochloric acid, carbon monoxide, carbon dioxide, nitric acid, ammonia, sulphur dioxide, sulphuric acid, hydrogen sulphide, sodium hydroxide.

"Attention should be given to the atmosphere (constitution and

relation to animal and vegetable life), flames, acids, bases, salts, oxidation and reduction, crystallization, manufacturing processes, familiar substances (illuminating gas, explosives, baking powder, mortar, glass, metallurgy, steel, common alloys, porcelain, soap).

"Combining proportions by weight and volume; calculations founded on these and Boyle's and Charles's laws; symbols and nomenclature (with careful avoidance of special stress, since these are non-essential); atomic theory, atomic weights and valency in a very elementary way; nascent state; natural grouping of the elements; solution (solvents and solubility of gases, liquids, and solids, saturation); ionization; mass action and equilibrium; strength (=activity) of acids and bases; conservatism and dissipation of energy; chemical energy (very elementary); electrolysis. Chemical terms should be defined and explained, and the pupil should be able to illustrate and apply the ideas they embody. The theoretical topics are not intended to form separate subjects of study, but to be taught only so far as is necessary for the correlation and explanation of the experimental facts.

"The facts should be given as examples from various classes, and not as isolated things. Thus to speak of a "standard method of preparing hydrogen," whereby the action of zinc on hydrochloric acid is meant, shows narrow and infertile teaching. It should be shown that all acids are acted upon by a certain class of metals to produce hydrogen. Examples of both classes of metals should be given and the general principles derived. The reason for using zinc and hydrochloric acid in the laboratory can then be stated.

"IV. Equipment.

"Chemistry can not be taught satisfactorily without a proper laboratory and a sufficient supply of apparatus. The former should contain desks, with gas and water connections, bottle racks, and well ventilated hoods. Each pupil should have his own set of apparatus.

"In view of the prevailing idea that quantitative experiments require expensive apparatus, it may be mentioned that a balance with case (Becker No. 31)—costing, when imported duty-free, $15—and weights ($1.25) will amply suffice, and some teachers secure good results by giving each pupil ordinary hand scales, costing less than $1.50. There should be one balance to every six

pupils working at one time. In addition to this the following will be required:

"Barometer; thermometers; burettes, two for four pupils at least; porcelain crucibles for each student; bottle for aspirator (one liter) for each student.

"Most of the apparatus for demonstration can be made by the teacher by use of the blowpipe, some glass tubing of various sizes, and a few pieces of thin platinum wire.

"It may not be out of place to add that a teacher competent to instruct a class after the fashion indicated here must have had considerable training in the several branches of the sciences. His minimum equipment will be: Physics (one year), general chemistry (one year), qualitative analysis (two terms; one term=twelve weeks), quantitative analysis (one term), theoretical chemistry (one term), organic chemistry (one term), some acquaintance with the history of the science, and familiarity with all the chief books suitable as works of reference in connection with such a course, and all of the text-books for secondary-school chemistry."

Of first importance is the qualifications of the teacher, next adequate laboratory equipment, and lastly a modern text-book, among which may be mentioned:

Remsen's *An Introduction to the Study of Chemistry* (Henry Holt & Co.); Newell's *Descriptive Chemistry with Experiments* (D. C. Heath & Co.); Hessler-Smith's *Essentials of Chemistry* (Benj. H. Sanborn & Co.); *First Principles of Chemistry,* by Raymond B. Brownlee, and others (Allyn & Bacon); *Special Experiments and Discussions in Introductory Chemistry,* by E. P. Schoch (D. C. Heath & Co.).

Under no circumstances should the teacher become enslaved to any one text-book. He should make it his business to be familiar with the literature of chemistry, especially as much thereof as may be serviceable in the work undertaken by him; and he should also feel it his duty to adopt a new text-book when in his opinion his work can be made more efficient by so doing.

THE TWO-YEAR COURSE IN HIGH-SCHOOL CHEMISTRY.

The two-year course in chemistry should prepare the candidate to stand a successful examination in:

1. General inorganic chemistry.

2. The general facts concerning metathetical reactions and the ionization theory.

3. A rational method of writing oxidation reactions, such as given in Prescott and Johnson's *Qualitative Analysis* (D. Van Nostrand Co.).

4. The nomenclature of salts, acids, and anhydrides, as presented with the "Periodic System" as a basis.

5. A comprehensive course in qualitative analysis, similar to that covered by A. A. Noyes's *Qualitative Analysis* (The Macmillan Co.).

An outline of the first half of the two-year course is given in the "Outline of the One-Year Course." For a more detailed outline, consult Schoch's *Special Experiments and Discussions in Introductory Chemistry* (D. C. Heath & Co.).

The second half, or second year, of the "two-years course" should give the pupil a firmer grasp of the fundamentals of inorganic chemistry. At least 200 hours should be given to the work—one-half of which should be spent in the laboratory. Two or three two-hour periods a week throughout the session should be devoted to laboratory work, and two or three periods a week throughout the session given to work in the class-room. The work in the laboratory should very fully cover as comprehensive a course in qualitative chemistry as is given in A. A. Noyes's *Qualitative Analysis,* and the theory of the reactions involved in the laboratory work should be presented in accordance with the present development of the theory of electrolytic dissociation. (Consult Talbot and Blanchard's *Electrolytic Dissociation.*) The work should include the analysis of a large number of "unknown" substances in solution, and also dry substances, *e. g.,* various salts, minerals, and commercial inorganic products.

The work in the class-room should include quizzes on the laboratory work, and a systematic treatment of inorganic chemistry equivalent to that given in Newth's *Text-Book of Inorganic Chemistry* (Longmans, Green, & Co.); Alexander Smith's *Introduction to General Inorganic Chemistry* (The Century Co.); Holleman's *Text-Book of Inorganic Chemistry,* Cooper's translation (Jno. Wiley & Son.); Remsen's *Advanced Inorganic Chemistry* (Henry Holt & Co.); or some other good text-book on chemistry.

In addition to adequate laboratory equipment, library facilities

should be provided for the teacher and pupils, and sufficient time should be allotted both to prepare and execute the work in a very thorough manner.

For fuller details consult the first eight chapters in Smith and Hall's *The Teaching of Chemistry and Physics* (Longmans, Green, & Co.).

The statement made in the one-year course in regard to the notebook applies with equal force here.

In conclusion it can not be too emphatically stated that the *first prerequisite* for the two-year course in high-school chemistry is a *competent teacher.* The course should not be undertaken unless a *competent teacher* and adequate time and equipment are provided. These items are expensive, and the trustees must be willing to meet the expense if the course is to be added to the curriculum. It should come in the senior or graduate year, and should be immediately preceded by the one-year course and a course in physics.

BOTANY IN THE HIGH SCHOOL

(One or two units may be offered.)*

The writer desires to take advantage of this opportunity to emphasize the importance of placing the study of botany in the curriculum of every high school in the State. It is his opinion, further, that every school supported by the State should offer instructions in botany on the ground that, as the State's resources are largely measured by the products of plant growth—cotton, cereals, lumber, fruit, grasses, and garden products,—the study would be supposed to improve the quality and increase the quantity of these staple products, and so add to the wealth and prosperity of the commonwealth. Even now, the State is committed to a policy of this kind in the purpose of having elementary agriculture taught in the public schools. It will be found that this course in elementary agriculture will consist in the main of botanical study in one phase or another, and incidentally it may be remarked that the botanical training in the high school will be utilized in large measure in carrying out the design.

To give more emphasis to the fact that provision for the study of botany in public schools is a good investment for the State, one need only point out what botanical investigations are doing at the present time in behalf of interests identified with the growing of plants. The National Government alone employs several hundred men trained in various lines of botany to carry on investigations with plants with a view to improving quality, increasing yield, or otherwise making their cultivation more profitable, and more than three million dollars is spent in this work annually. As a result, varieties of cotton are being discovered which either have a better staple or more of it, or which mature earlier or are more immune against the attacks of cotton enemies. Similarly, varieties of wheat have been originated which are better suited to hot, dry climates, which resist the rust better, and whose grain is more valuable, by reason of its hardness, for special purposes.

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*A two-unit course in botany will be furnished on application to the Visitor of Schools.

And so on with corn and other grains, with fruits and vegetables, with cattle ranges, forests, *et cetera.* These gains come about as a consequence of a clear insight into the phenomena of plant life toward which the study of botany leads.

Returning to the first statement about the importance of botany in the high school, the utilitarian idea just exploited is to be placed second to the value of botany as a means of education. There is, of course, here involved a training of the powers of observation and discernment, of dexterity in manipulation and of clearness and conciseness in expressing judgments, but of special importance is the field of knowledge with which the study acquaints one. It is the domain of biology. Here one inquires as to the origin and properties of living substance. He observes how it expresses itself in organized forms, and how from a simple beginning there has been an unfolding into countless forms of great diversity and complexity, but all united by the tie of common descent. One may not stop to specify further, but we may accept the oft-repeated statement that no other field of study in modern times has had so profound an influence upon the thought of the world as the study of biology. It would be poor economy that continued to neglect so powerful an educational agency.

The argument here is, of course, for biology in general rather than for plant biology alone. That would, no doubt, be the better course which considered both the field of plant biology and of animal biology together, but since there are limitations as to the scope of the course and preferences as to the agreeableness and availability of materials for study, the case of botany is here especially set forth. This leads to the presentation of a third reason for placing botany in the course of study, namely, that the materials are abundant, conveniently at hand and agreeable to work with and that no large initial expense is necessary in providing for the work, though to be sure the possession of compound microscopes, for example, would be a great advantage.

Briefly, then, the study of botany is emphasized, first, because of its training value; second, because it furnishes a rational basis of knowledge upon which to develop the State's largest resources; third, because of the moderate expense in organizing and maintaining the course and of the abundance, availability, and agreeableness of the materials worked with.

THE NATURE OF THE COURSE.

In spite of the abundance of material to draw from, it has been no easy matter to decide what should be utilized in a high-school course or in what order to present it. The selection becomes still more difficult where the equipment does not include compound microscopes. This much seems certain, that the old system of analyzing flowers and laboriously struggling through a key to the Latin name, of amassing a vocabulary of meaningless names of parts whose structure and function might be wholly unsuspected, is to be discarded as practically worthless for educational purposes. Not only have much time and energy been wasted along this line, but by assuming this procedure to represent botanical study the virility of the subject has been brought into question. If we keep in mind that this is a biological study, then we confine our choice of material to that which will give insight into biological phenomena; *i. e.*, we shall study largely living plants themselves. Accordingly, physiology which deals with life processes, together with structure and adaptation of organs through which the functions are performed, will form the basis and largely the content of the course.

It is maintained by some very superior teachers of botany, that in the high-school course the student should begin with the lowest forms of plants and (assuming an equipment of compound microscopes) follow a series of types representing the various groups of plants from the lowest to the highest. This order is followed in the first year's work in botany at the University of Texas. For high schools, however, where the students are somewhat less mature and where there may be no compound microscopes, it seems more advisable to begin with objects that are more or less familiar and easily seen and handled. Since in popular belief, if not in fact, the cycle of life in the highest plants begins with the seed, that familiar structure furnishes a good beginning point from which the cycle of life in the individual may be followed in its evolution from the relatively minute embryo through its germination period, its seedling stage, and so on to the mature plant which in turn produces seed like that from which itself sprang.

Following this could be taken up the study of the plant kingdom, in which, as in the preceding part, the most primitive plants are

studied first and the more advanced successively in the order in which they seem to have evolved, until the highest—the higher seed plants—are reached. This part may be made brief, as, indeed, it would need to be in case no compound microscopes were available.

A third part is further recommended which shall have in view the adaptation of plants to their environment. The first division will continue from the point reached in part two which ends with the study of the lily as a type of angiosperms. It will endeavor to trace the evolution of the flower through a series of progressive groups running from the most primitive to the most advanced. The evolution here meant is that along the line of adaptation to pollination by special agencies—especially insects.

The second division of part two will consider the subject of adaptation to physical environment of which climate and soils are the two general groups of factors. It will show how the factors of light, temperature, moisture, soil texture, etc., influence the structure and distribution of plants and will in particular deal with the plant geography of Texas from which a great wealth of illustration may be drawn.

Such is in brief the plan of the course of study recommended for the high schools. It is by no means prescribed *in toto*, but it is believed advisable to embrace in the year's work as wide a range of subjects as is here given.

Following is a synopsis of the three parts of the course:

Part I. The study of a series of typical seeds; general structure, relation of embryo to food supply, experiments to determine vital processes in germinating seed. The seedling and the establishment of its relation to soil, light and other factors of its environment—especially with reference to nutrition. The gross anatomy and so far as possible the minute anatomy of roots, leaves, and stems considered especially in connection with the functions of these organs; variations in form and structure in roots, leaves and stems as adaptations to special purposes. The flower considered briefly as a shoot with its leaf members especially adapted by correlation to promote the vital function of reproduction.

Part II. The study of a series of types representing the large groups of the Plant Kingdom; the gross structure and, with compound microscopes, the minute structure is to be studied and

in each case the life history, *i. e.,* the complete cycle of the individual is to be learned. The types embrace: a green alga, preferably Spirogyra, with superficial examination of numerous others; a moss, preferably the common Funaria; a fern, the maiden hair fern or the bracken fern (Pteris); Equisetum, and by special arrangement for collection, a Selaginella; the pine—any one of the three native Eeastern Texas species will answer; the lily—adder tongue, crow poison, Camassia, easter lily, etc., will answer. In the study of the lily at this point only the floral structures are to be considered and in this, the attempt will be to understand the lily flower in its relation to the reproductive organs of the immediately preceding groups of plants.

Part III. From the study of the minute structure and function of the lily flower pass to the study of a series of flower types designed to show the evolution of the flower in its relation to pollinating agencies—especially insects. From Monocotyledons select, say, the following: The cat-tail flag, or the pond weed, a grass (the oat flower), water plantain or arrowhead, a lily, an Amaryllis, Iris, and Canna. From the Dicotyledons: The willow, or pecan, hackberry, buttercup, or Anemone, or Magnolia, larkspur, or columbine, geranium, or Oxalis, and nasturtium, the cotton blossom, the violet, the bluebonnet, or the sweet pea, the pink, evening primrose, nightshade, or morning glory, Salvia, or horsemint, honeysuckle, "dandelion" (Pyrrhopappus), "ragged robin" (Lygodesmia), thistle or Centaurea, sunflower, or "fire wheel" (Gaillardia pulchella).

The second division of part III: The Plant Geography of Texas. There will first be a brief general consideration of the environmental factors which influence the structure and habits of plants—temperature, moisture, light, soil texture, soil chemistry, etc., and specific illustrations of the effect they produce singly and in cooperation. Next, these factors will be considered in their specific relation to the Texas region and the distribution of plants as determined by them, but more especially the association of plants together forming characteristic types of vegetation or vegetation formations; *e. g.,* forest, prairie, chaparral. From these formations prominent species are to be selected for a study of the special adaptations in form and structure to their particular

habitat, *e. g.,* prickly pear and other cacti, spanish-dagger, long leaf pine, shade plants, water plants, etc.

For the subjects comprised in Parts I, II, and the first division of III, such texts as Atkinson, Bergen, Leavitt, and Stevens are to be recommended. Some of these also introduce the subject of plant geography, but the particular presentation of the subject indicated here—based on Warming's *Ecological Plant Geography*—has not yet been made available for use in any text-book in this country.

AMOUNT OF WORK REQUIRED FOR AFFILIATION.

In the scheme of elective entrance requirements to the University, botany, where offered, may absolve one or two units. One unit of credit presupposes one full year of botanical study with the equivalent of one daily exercise of forty minutes duration for a term of at least thirty-six weeks. Two units of credit presuppose double this amount of work. It is further required that at least one-half the course be devoted to laboratory work. For the remainder there will be regular class periods in which the teacher will present new subjects or summarize work by lectures, hear recitations from text-books, reports upon collateral reading, experiments, field work, and so on. It would be preferable to have laboratory periods of double the length of the recitation period. The arrangement recommended would be, two class exercises weekly and three double laboratory periods weekly.

EQUIPMENT.

It was intimated in the previous paragraph that the initial equipment for botanical study need involve no large outlay of funds. Let this not be a misleading statement. A liberal equipment is highly desirable in order to insure reasonably efficient work. But if high schools wait for equipment, the introduction of botany will be too long delayed. Better begin with what can be had and gradually acquire the rest. There may be no room for a laboratory, no extra time for laboratory periods, no compound microscopes; still, if there be a teacher who knows botany and can teach it, who knows where to find material for study and how to utilize it, who has some skill in devising experiments, the course will succeed anyhow, and the material equipment will inevitably

follow. The *sine qua non* of equipment, then, is a good teacher well equipped to teach botany. On the average, it is safe to say that when a live teacher of natural science demonstrates objectively the value of his work, the trustees come forward with equipment money.

Let more good teachers get thoroughly prepared to carry on laboratory science courses in the high school, and it will not be long until every high school in the State will have a laboratory reasonably equipped for at least one of the natural sciences.

In order to meet the need for specific information in regard to the nature and cost of equipment for laboratory work in the high school, there are given here two estimates of which the first, "A," may be described as liberal, the second, "B," as very moderate. Both estimates are based on accommodations for twenty students at one sitting.

Estimate A.—A Liberal Equipment.

1.	Special laboratory room, well lighted, preferably with east and north exposure. Water and gas connections, if possible.	
2.	Five laboratory tables, each accommodating four pupils; one drawer and locker for each student, made by local mill or carpenters, from special design; estimated cost	$ 60 00
3.	Ten compound microscopes, at $30 each	300 00
4.	Twenty dissecting microscopes, at $3 each	60 00
5.	One wall case for instruments and supplies; made by local workmen from special designs; estimated cost	15 00
6.	Standard section of herbarium case, made as in 5; estimated cost	10 00
7.	Twelve to twenty feet of broad table shelving for aquarium jars, cultures, standing experiments, etc., estimated cost	10 00
8.	Glassware, pots, germinating trays and other utensils for growing specimens and for experiments; estimated cost	10 00
9.	Standard chemicals, preserving fluids, etc., estimated cost	10 00

10. Plant press, drying and pressing paper, collecting box; estimated cost..... 5 00
(Most of these items furnished also by the students as a part of their own equipment.)
11. Reference books; see *list below; estimated cost about..... 50 00

Total estimated cost.....$ 530 00

Estimate B.—A Very Moderate Equipment.

1. Regular recitation room and desks to be used for laboratory exercises.
2. Special case of drawers and shelves for supplies; estimated cost $10 00
3. Twenty dissecting microscopes, home made; students furnish their own lenses; estimated cost..... 5 00
4. Utensils for growing class material, experiments, etc.; estimated cost 5 00
5. Jars for preserved specimens preserving fluid, etc., estimated cost 5 00
6. Outfits for pressing plants, furnished by students.
7. Books 3, 9, 18, 28, 29, 34, 35, 36, in list below, about. 25 00

Total about $55 00

REFERENCE LIBRARY.

The following list of books is recommended as a liberal equipment in collateral reading. Such a list offers opportunity for students to properly organize and relate the knowledge they gain in class and in the laboratory. The books starred (*) in this list are recommended for estimate "A." Specially selected ones for estimate "B," as shown above. For convenience, the publisher and list price are given with each:

Book List.

1. Arthur, Barnes, and Coulter, *Handbook of Plant Dissection,* superseded by Caldwell's *Handbook of Plant Morphology* (Holt, 1904).....$ 1 00

2. Arthur and MacDougal, *Living Plants and Their Properties* (New York, Baker & Taylor) 1 25
*3. Atkinson, *Elementary Botany* (Holt) 1 25
4. Atkinson, *Lessons in Botany* (Holt) 1 12
5. Bailey, *Lessons with Plants* (N. Y., Macmillan & Co.) 1 10
*6. Bailey, *An Elementary Text-Book* (Macmillan) 1 10
7. Bailey, *Plant Breeding*, 3d Ed. (Macmillan) 1 25
8. Barnes, *Plant Life* (Holt) 1 12
*9. Bergen, *Foundations in Botany*, Southern edition (Boston, Ginn & Co.) 1 50
10. Bergen, *Teacher's Manual* (Ginn) 30
11. Bergen, *Elements of Botany*, Revised (Ginn) 1 00
12. Bessey, *The Essentials of Botany* (Holt) 1 08
13. Britton, *Manual of Botany of the Northeastern United States* (Holt) 2 25
14. Caldwell, *Laboratory and Field Manual of Botany*, (N. Y., Appleton & Co.) 90
See also 1, above.
*15. Campbell, *Lectures on the Evolution of Plants* (Macmillan) 1 25
*16. Campbell, *A University Text-Book of Botany* (Macmillan) 4 00
17. Clements and Cutter, *Laboratory Manual in High-School Botany* (Univ. Pub. Co.) 75
*18. Coulter, *Plant Relations and Plant Structures* (Appleton) 1 80
19. Coulter, *Plant Studies* (Appleton) 1 25
*20. Coulter, *Botany of Western Texas* (Supt. of Documents, Washington, D. C.) 50
21. Curtis, *Text-Book of General Botany* (N. Y., Longmans, Green, & Co.) 3 00
*22. Conn, *Agricultural Bacteriology* (N. Y., P. Blakiston & Sons) 2 50
23. Darwin, *Insectivorous Plants*, 6th Ed., (N. Y., Appleton) 2 00
*24. Darwin, *Fertilization of Orchids*, 6th Ed. (N. Y., Appleton) 2 00
*25. Ganong, *The Teaching Botanist* (Macmillan) 1 10

*26.	Ganong, *Laboratory Course in Plant Physiology* (Holt)	1 00
*27.	Green, *Principles of American Forestry* (N. Y., John Wiley & Sons)	1 20
*28.	Kerner, Translated by Oliver, *Natural History of Plants,* 2 vols. (Holt)	11 00
*29.	Leavitt, *Outlines of Botany with Flora* (N. Y., American Book Co.)	2 25
*29a.	Lloyd and Bigelow, *The Teaching of Biology* (Longmans, 1904)	1 50
30.	MacDougal, *Practical Text-Book of Plant Physiology* (N. Y., Longmans)	3 00
31.	Pammel, L. H., *Ecology* (Ames, Iowa)	3 00
32.	Parker, *Elementary Biology,* 6th or later Ed. (Macmillan)	3 00
*33.	Setchell, *Laboratory Practice for Beginners* (Macmillan)	90
*34.	Small, Dr. John K., *Flora of the Southeastern United States,* good westward to 100th meridian (N. Y., Botanical Garden, Bronx Park, N. Y.)	2 50
*35.	Spalding, *Guide to Study of Common Plants* (Boston, D. C. Heath & Co.)	90
*36.	Stevens, *Introduction to Botany—Key and Flora,* (Heath)	1 25
37.	Strasburger, Noll, Schenck, and Schimper, translated by Porter, *A Text-Book of Botany* (Macmillan) .	4 00
38.	Underwood, *Our Native Ferns and Their Allies* (Holt)	1 25
*39.	Warming, English translation, *Plant Geography* (Oxford, Clarendon Press; apply to Lemcke & Buechner, New York, N. Y.)	(?)

Dealers in Laboratory Supplies.

The following firms are mentioned because of the writer's personal knowledge (through several years of business relation) of the standard quality of the goods furnished at usual market prices:

Bausch & Lomb Optical Co., Rochester, New York.

Cambridge Botanical Supply Co., Cambridge, Mass.

Kny Scheerer Co. (Importers), New York.
Spencer Lens Co., Buffalo, N. Y.
Williams, Brown & Earle, 918 Chestnut St., Philadelphia.

Student Equipment.

In a laboratory course, certain items of equipment are customarily furnished by the student himself. Such equipment is rarely of so great expense as to seriously deter students from pursuing the course.

1. A text-book. See 3 or 9, or 18 or 29, in book list. Cost $1.10 to ..... $ 2 00
2. A magnifying glass. Cost 50 cents to..... 75
3. Drawing paper and pencil, note paper and manila cover for notes and drawings..... 50
4. Home-made dissecting needles.
5. Sharp pocket knife or old razor.
6. Home-made plant press.

Total cost need not exceed..... $ 3 50

Other desirable, though not indispensable items—*e. g.,* forceps, section razor, tin collecting box—may be added as means and inclination permit.

THE IMPORTANCE OF LABORATORY WORK.

Too much stress can not be laid upon this method of pursuing a course in natural science. It is the means of direct contact with the objects of study and of training in methods of work, in habits of close observation, in verbal expression of accurate judgments, in dexterity of manipulation, and in skillfulness in illustrative drawings.

For the surer realization of the ends sought in pursuing laboratory work certain fundamental requirements may be stated:

1. The time of the laboratory period is to be fully employed by every member of the class. This is largely a matter of skill on the instructor's part in providing suitable materials and in giving specific directions as to what is required.

2. Heedless and slovenly ways of working are not to be tolerated. Some of the best results to be expected in laboratory work are neatness, deftness, and right ways of doing things.

3. The student is required to keep a suitable record of his work in the form of a book of notes and drawings bound together under manila or pasteboard cover. The making of this book is of the greatest importance. In laboratory work the student may forget text and other authority and himself become an investigator in new fields, the results of which investigations he must embody in a book of which the one feature is that it represents the best he can do in discovering and recording facts that to him are new. The work is his own. On this account it is better that his originality should crop out in crude though fairly exact drawings than that these should be reduced to the common level of a copy of some diagrammatic crayon drawing or chart or text figure.

4. The content of laboratory work should embrace not only the study of form and structure, but also experiments demonstrating vital processes—respiration, growth, starch formation, absorption of nutriment, the effect of gravity and light on growing organs, etc., etc. Furthermore, the fixed hours and subjects of work in the laboratory are to be supplemented by field excursions under personal supervision and by the largest possible amount of individual effort. Here, let us emphasize the special value of leading students to undertake larger tasks involving the cultivation of plants on a relatively large scale for experimental purposes. Each separately, or several jointly may establish experiment "farms" upon which really valuable operations may be carried on. The following are illustrations of possible field demonstrations:

(a) To show the difference between plants grown in the open and under partial shade, using lattice work or cheesecloth.

(b) To show the difference between plants of the same species grown in soils of different texture and chemical content.

(c) To show the difference between cotton plants grown from small inferior seed and those from large vigorous seed taken from a vigorous plant.

(d) To compare results between plats of cotton planting when little cultivated and when frequently cultivated.

In short, those very problems which are of vital concern to the farmer, and upon which a great deal of attention is being concentrated, may be taken up by students in a botany class as a feature of laboratory work—not to supplant that done in the laboratory proper, but to extend and supplement it. It is not

suggested that these larger operations be attempted as the regular work of the class—certainly not to begin with, lest they involve a very impracticable situation—but they indicate the direction in which the study of botany *may be made to take hold of practical matters at a specific point.* Such operations might be extended to comprise the varied work of regularly established school gardens on the one hand, or to include experiments in cultivating the various plants of field, garden, orchard, and landscape gardening.

MANUAL TRAINING IN THE HIGH SCHOOL

(One or two units may be offered.)

The following course of study in manual training is now in operation in the Allan Manual Training School, Austin. This course fully meets the requirements of the University of Texas for two units of entrance credits.

COURSE OF STUDY IN MANUAL TRAINING.

First Year.—First Term.

Wood-Working. — Two forty-five-minute periods per week throughout the term.

The following models are used as a basis of the course: Pen tray, ink-stand, letter-paper stand, footstool, crumb tray, tabouret, table.

Decoration by line grooving, chip carving, and oil and water-color, singly or in combination, and staining, is encouraged throughout the course. Increased play to individual thought in character and decoration of models on the part of the pupil is encouraged.

Second Term.

Three ninety-minute periods per week throughout the term.

Equipment same as used in the Low Eighth Grade, with a few additional tools, such as molding planer, band saw, scroll saws, etc., introduced to make the work more effective.

Almost all of the work is such as to give the pupil a chance to develop individuality. Larger and more useful projects are encouraged.

Class-room talks, illustrated by maps, etc., are given as follows:

The distribution of lumbering forests in the United States.

The process of lumbering; the woods of Texas. Some of the main uses of the most important woods.

Second Year.—First Term.

Wood-Working.—Turning in wood. Three ninety-minute periods per week throughout the term.

Equipment consists of bench equipment as in the Eighth Grade, and a complete equipment of turning lathes with tools.

The work in turning is divided into two classes:

(a) Work held between centers.

Here the pupil learns the use of the gouge and skew-chisel in turning cylinders, cones, beads, convex and concave curves; compound curves in making chisel-handles, balusters, etc. Finally he makes some object requiring the use of tools thus far handled.

(b) Face-plate and chuck work.

1. Use of face-plate in making rosettes, simple boxes, vases, cups, etc.

2. Use of face-plate and chuck in "built-up" work, such as trays, fancy vases, and large boxes.

3. Making such objects as require special methods of holding in by bell-chucks, such as balls, etc.

It is the aim to have the pupil make some object of value from his own design, or from some selected standard form, both as a project in turning and as a most valuable practical lesson in designing.

Such models as candlesticks, tool-handles, dumb-bells, napkin rings, boxes, towel-rings, bowls, typical vase forms, darning balls, etc., are turned in soft wood and then decorated by means of carving, paint, and pyrography.

Pupils study the structure and properties of wood; processes of drying and preserving lumber, and the principles governing wood construction.

Second Term.

Pattern-Making and Moulding.—Three ninety-minute periods per week throughout the term.

Equipment consists of complete set of individual molding benches, each supplied with a full set of molding tools. The benches and lathes used in the wood-working room are used by the classes in pattern-making. The pupil is taught the meaning of the terms used in pattern work and moulding and their significance, and what is the best practice in making good patterns. Both good and bad patterns are moulded and comparisons made. He begins with a simple solid pattern and progresses by easy steps until he is able to make complex parted and cored pat-

terns. Such patterns as pipe-bends, pulleys, gear-wheels, and those from which castings must be made for further use in the machine shop form the basis of the course.

Third Year.—First Term.

Forging.—Three ninety-minute periods per week throughout the term.

In this course the pupil gets all the instruction necessary to master the fundamental principles of forging iron and steel. The exercises are so selected as to bring out the processes of drawing, upsetting, shaping, punching, welding, and tempering of steel.

Talks are given by the teacher on the important iron and steel processes as follows:

The nature of the common iron ores.

The distribution of coal and iron ores in the United States.

Relation to industrial development.

The fundamental factors involved in the blast furnace, puddling, Bessemer, open hearth, and crucible steel processes.

The characteristics and important uses of the products of these processes.

Such exercises as the following form the basis of the course: staple, hasp, door-hook, chain and hook, meat-hook, pulley block, bracket, wrench, ice hatchet, chisel, gouge, drawing knife, etc.

Second Term.

Forging.—Three ninety-minute periods per week.

This class will complete the course started in the Low Tenth Grade, and will prepare a set of lathe tools for use in the machine shop.

Fourth Year.—Both Divisions.

Machine Work.—Three ninety-minute periods per week throughout the term.

A very carefully graded series of exercises involving the use of the lathe, planer, drill, milling machine, and speed lathe is worked out by the student, and the work must be so accurate in many instances that a mistake of a thousandth of an inch will render the work useless. In this course the student learns the use of the common machine tools and the elementary principles of machine design.

Cast iron, wrought iron, steel, and brass are the materials used.

The engine lathe work consists of straight and taper turning, boring, thread cutting (external and internal), and chuck work.

The speed-lathe work consists of centering, drilling, and countersinking, and the turning of simple forms by hand tools.

The planer work consists of the making of plane and curved surfaces.

The drill work consists of the study of the speed of drills, the use of different kinds of drills, counterboring, and sharpening drills.

The milling machine is used to produce plane and curved surfaces, mill key-ways, slots, and the teeth of gear-wheels, etc.

Such models as the wrench, level, lathe center, paper-weight, plumb-bob, bicycle pump, small dynamo, motor, and steam engine form the basis of the course.

The student makes a study of the different kinds of power during the year.

As far as the time permits, he makes a study of the following:

Development of the steam engine in the nineteenth century.

Importance in production and transportation.

The part played by machinery in modern civilization.

Characteristics of machine work as compared with hand work.

The tendency of improvements in machinery to replace manual labor by automatic devices, and its significance.

COURSE OF STUDY IN DRAWING.

First Year.—First Term.

1. Lettering.
2. Use and care of instruments.
3. Simple geometric construction with lettering.
4. Slant lettering.

Second Term.

1. Principles of Orthographic Projection (pencil and ink).
2. Working drawings of common objects, in part related to work in shops.
3. One sheet of Orthographic Projections.

Second Year.—First Term.

1. One sheet of plan of simple house, stable, wood-shed, or bungalow.
2. One sheet of Elevation of No. 1.
3. One sheet of problems in Projection (in ink shaded).

Second Term.

1. One sheet of working drawings of machine parts in detail.
2. One sheet drawing of above machine parts, assembled (cross-section).
3. One sheet of Isometric Drawings (tinted or grained in black).

Third Year.—First Term.

1. One sheet Geometric constructions.
2. Two sheets intersections and developments of surfaces (tinted).
3. One sheet free-hand perspective.
4. One sheet of simple linear perspective.

Second Term.

1. One sheet of methods used in representing surfaces (pen and ink and brush).
2. One sheet Lettering.
3. Two sheets of Geometric problems—ellipses, cycloids, involutes, helix, etc.

Fourth Year.—First Term.

1. Two sheets of shades and shadows.
2. One sheet studies of bolts, nuts, and threads.
3. One sheet problems in gearing.

Second Term.

Four sheets of house plans, elevations, and details (specifications if time permits).

LIST OF AFFILIATED SCHOOLS

B..... Botany.
C..... Chemistry.
Civ.....Civics.
D..... Drawing.
E..... English.
F..... French.
G..... German.
Gr..... Greek.
H..... History.
L..... Latin.
M.....Mathematics.
M. T.....Manual Training.
P..... Physics.
P. and H.... Physiology and Hygiene.
Ph..... Physiography.
S.....Spanish.
S. G.....Solid Geometry.
T..... Trigonometry.

(Abbreviations represent the minimum numbers of units allowed in the several subjects, e. g., E=English, 3 units; figures, in parentheses, follow abbreviations when schools have more than the minimum number of units in any subject, e. g., H.(3)=History, 3 units.)

GROUP I.

Academy of Our Lady of the Lake, San Antonio.....
.....E., H., M., G.(3), P., P. and H., Civ.
Alexander Collegiate Institute, Jacksonville.....E., H., M., L., Gr., G.
Allen Academy, Bryan.....E., H., L., M., G., S. G., T.
Amarillo High School, Amarillo.....E., H., M., L., S.
Austin High School, Austin.....
.....E., H.(2½), M., L., G.(3), B., P., C., Civ., M. T.(2), S. G., T.
Austin Male Academy, Austin.....E., H., M., L., G.(3).
Ball High School, Galveston.....
.....E., H.(3), M., L., Gr.(3), F.(3), G.(3), S.(3), C., P., Ph.
Beaumont High School, Beaumont.E., H., M., L., G.(3), C., P., S.(3), F.(3).
Belton High School, Belton.....
.....E., H.(2½), M., G., L., P., B., Civ., M. T.
Blinn Memorial College, Brenham.....
.....E., H.(2½), M., G.(3), P., Ph., P. and H., C., Civ.
Bonham High School, Bonham.....E., H., M., L., B., C., P., Ph., G.
Brownwood High School, Brownwood.....E., H., M., L., P., Ph., Civ.
Caldwell High School, Caldwell.....E., H., M., L., G.
Calvert High School, Calvert.....E., H.(3), M., L., C., S. G., T.
Cameron High School, Cameron....E., H.(½), M., L., G., C., P., Civ., Ph.
Cleburne High School, Cleburne.....E., H.(4), M., L., P., B.
Coronal Institute, San Marcos.....E., H., M., L., C., G., S.
Corsicana High School, Corsicana.....
.....E., H.(3), M., L., F., G., C., P., T., Ph., Civ., S. G.
Dallas High School, Dallas.....
.....E., H.(2½), M., L., C., P., G., P. and H., S. G., T., M. T.(2).

Denison High School, Denison.....E., H., M., L., C., P., G., B., T.
Denton High School, Denton..E., H., M., L., C., P., P. and H., Civ., T., Ph.
El Paso High School, El Paso.....E., H., M., L., S., C., P., Ph., P. and H.
Ennis High School, Ennis.....E., H., M., L., G., C.
Fort Worth High School, Fort Worth.....
.....E., H.(2½), M., L., G., Civ., M. T., T., S. G.
Gainesville High School, Gainesville.....E., H., M., L., G., S.
Grayson College, Whitewright.....E., H., M., L.(4), S. G., T.
Greenville High School, Greenville.....E., H., M., L., P., C., B., P. and H.
Hico High School, Hico.....E., H.(3), M., C., P., L., Civ.
Hillsboro High School, Hillsboro.....E., H., M., Ph., P., L., Civ.
Houston Heights High School, Houston.....E., H.(2½), M., L., G., Civ.
Houston High School, Houston.....
.....E., H.(2½), M., L., P., C., G.(3), Civ., S.(3), M. T., S. G.
Hubbard High School, Hubbard.....E., H.(2½), M., L., Civ., P.
John C. French High School, Cuero.....E., H., M., L., G., S. G., T.
Lockhart High School, Lockhart.....E., H., M., L., P., C.
Marlin High School, Marlin.....E., H.(3), M., L., P., M. T., Ph., S. G.
Marshall High School, Marshall.....
.....E., H.(2½), M., L., C., P., S. G., Civ., P. and H.
Mansfield Academy, Mansfield.....E., H., M., G.(3), S. G., T., P.
Mexia High School, Mexia.....E., H.(3), M., L., C., P., S. G.
Mineola High School, Mineola.....E., H.(3), M., L.(4), Gr.(3), S. G., T.
Mrs. Mulholland's School, San Antonio.....E., H., M., L.(4), F.(3).
Navasota High School, Navasota.....E., H., M., L., P., C., G., S. G.
Palestine High School, Palestine.....E., H., M., L., G.
Paris High School, Paris.....E., H., M., L., G., S.
San Angelo High School, San Angelo.....E., H.(3), M., L., P., S. G.
San Antonio High School, San Antonio.....
.....E., H.(3), M., L., Gr., G.(3), S.(3), B., Ph., P., Civ., S. G., T.
San Antonio Academy, San Antonio.....E., H., M., L., G., S. G., T.
Taylor High School, Taylor.....E., H., M., L., P., M. T., Civ.
Temple High School, Temple..E., H.(2½), M., L., G.(3), C., P., Civ., S. G.
The Terrill School, Dallas.....E., H., M., L., F., G., S. G., T.
Texas Female Academy, Weatherford.....E., H., M., L., G.
Thomas Arnold High School, Salado.....
.....E., H.(2½), M., L., Gr., P., P. and H., Civ., S. G.
Tyler High School, Tyler.....E., H.(3), M., L., P., Ph.
University Preparatory School Austin.....E., H.(3), M., L., G., F.
Uvalde High School, Uvalde.....E., H., M., L., S.
Victoria High School, Victoria.....E., H.(3), M., L., B., C., Ph.
Waco High School Waco..E., H.(½), M., L., P., Civ., Ph., P. and H., S. G.
Waxahachie High School, Waxahachie..E., H., M., L., C., P., Ph., Civ., S. G.
Weatherford Training School, Weatherford.....
.....E., H., M., L., Gr., Civ., S. G.

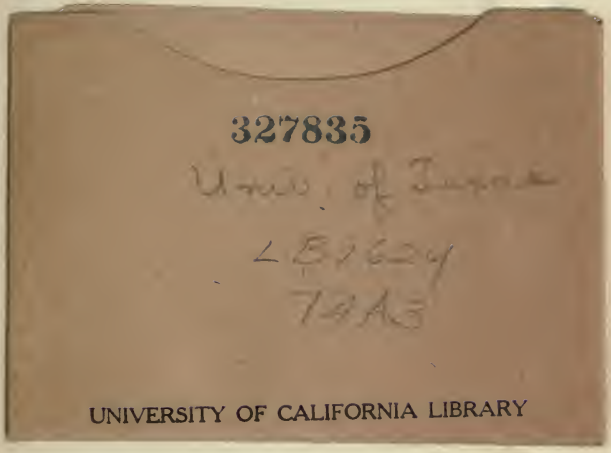
Weatherford High School, Weatherford.....E., H.(2½), M., L., P., Civ.
Whitis Avenue School, Austin.....E., H.(3), M., L., G., F., Ph., S. G.

GROUP II.

Abbott High School, San Angelo.....E., H., M., L.
Abilene High School, Abilene.....E., H., M., L., P.
Alice High School, Alice.....E., H.(2½), M., S., Civ.
Bastrop High School, Bastrop.....E., H., M., L.
Belton Academy, Belton.....E., H., M., L.
Big Springs High School, Big Springs.....E., H., M., L.
Bowie High School, Bowie.....E., H., M., L., S. G., T.
Brady High School, Brady.....E., H.(3), M., L.
Brenham High School, Brenham.....E., H.(3), M., G.
Bryan High School, Bryan.....E., H., M., L.
Colorado High School, Colorado.....E., H., M., L., P.
Comanche High School, Comanche.....E., H., M., L., Civ., P. and H.
Corpus Christi High School, Corpus Christi.....E., H., M., S.(3), S. G., T.
Crockett High School, Crockett.....E., H., M., L.
Dublin High School, Dublin.....E., H., M., L.
Gonzales High School, Gonzales.....E., H., M., L., Ph.
Groesbeck High School, Groesbeck.....E., H., M., L.
Honey Grove High School, Honey Grove.....E., H., M., L., P., S. G.
Kaufman High School, Kaufman.....E., H., M., L.
La Grange High School, La Grange.....E., H., M., G.(3).
Longview High School, Longview.....E., H., M., L.
McGregor High School, McGregor.....E., H., M., L.
McIlhaney Academy, Stephenville.....E., H., M., L.
McKinney High School, McKinney.....E., H., M., L.
Nacogdoches High School, Nacogdoches.....E., H., M., L.
Orange High School, Orange.....E., H., M., L.
Pilot Point High School, Pilot Point.....E., H., M., L., P.
Plano High School, Plano.....E., H., M., L., P. and H.
Port Arthur High School, Port Arthur.....E., H., M., P., L.
Port Lavaca High School, Port Lavaca.....E., H., M., L.
Quanah High School, Quanah.....E., H., M., L., Civ., S. G.
Sherman High School, Sherman.....E., H., M., L., B.
St. Mary's Academy, Austin.....E., H., M., G. (3), S. G.
St. Matthews School for Boys, Dallas.....E., H.(2½), M., L., Civ.
Sulphur Springs High School, Sulphur Springs.....E., H., M., L.
Sweetwater High School, Sweetwater.....E., H., M., L.
Terrell High School, Terrell.....E., H., M., L.
Texarkana High School, Texarkana.....E., H., M., L.
Van Alstyne High School, Van Alstyne.....E., H., M., L.
Wolfe City High School, Wolfe City.....E., H.(2½), M., L., Civ., S. G.

GROUP III.

Carlisle Military School, Arlington....E. H., M.
Center High School, Center....E., H.(3), M., T.
Clarksville High School, Clarksville....E., H., M.
Columbus High School, Columbus....E., H., M.
Douglas-Schuler School, Waco....E., H., M.
Elgin High School, Elgin....E., H., M.
Gatesville High School, Gatesville....E., H., M.
Henderson High School, Henderson....E., H., M., S. G., T., Civ.
Henrietta High School, Henrietta....E., H., M.
Institute for Blind, Austin....E., H., M.
Italy High School, Italy....E., H., M.
Itasca High School, Itasca....E., H., M., P.
Kelley School, Austin....E., H., M.
Ladonia High School, Ladonia....E., H., M.
Lampasas High School, Lampasas....E., H.(3), M., P.
Laredo High School, Laredo....E., H., M., S.
Llano High School, Llano....E., H., M.
Luling High School, Luling....E., H., M., P.
Marble Falls High School, Marble Falls....E., H., M.
Mineral Wells High School, Mineral Wells....E., H.(3), M., P.
North Ft. Worth High School, North Ft. Worth..E., H., M., Civ., P., S. G.
Rockdale High School, Rockdale....E., H., M., Civ., S. G.
Rock Springs High School, Rock Springs....E., H., M.
Runge High School, Runge....E., H., M.
San Marcos High School, San Marcos....E., H., M.
San Saba High School, San Saba....E., H., M.
Seguin High School, Seguin....E., H., M., G.
Seymour High School, Seymour....E., H., M.
Smithville High School, Smithville....E., H., M., Ph.
State Orphan Home, Corsicana....E., H., M.
Timpson High School, Timpson....E., H.(3), M., S. G., T.
Tivy High School, Kerrville....E., H., M.
Troupe High School, Troupe....E., H., M., S. G., T.
University Military School, Dallas....E., H., M.
West Texas Military Academy, San Antonio....E., H., M.
Wichita Falls High School, Wichita Falls....E., H.(3), M., Ph.
Yoakum High School, Yoakum....E., H., M.



THE UNIVERSITY OF TEXAS BULLETIN

SCIENTIFIC SERIES

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